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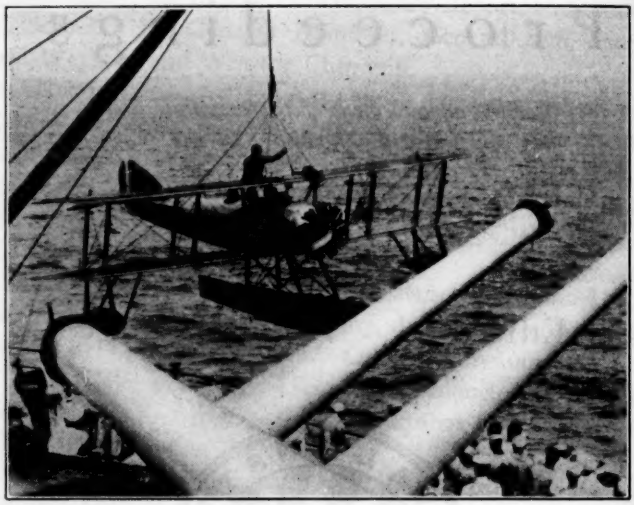

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The writers only are responsible for the contents of their respective articles

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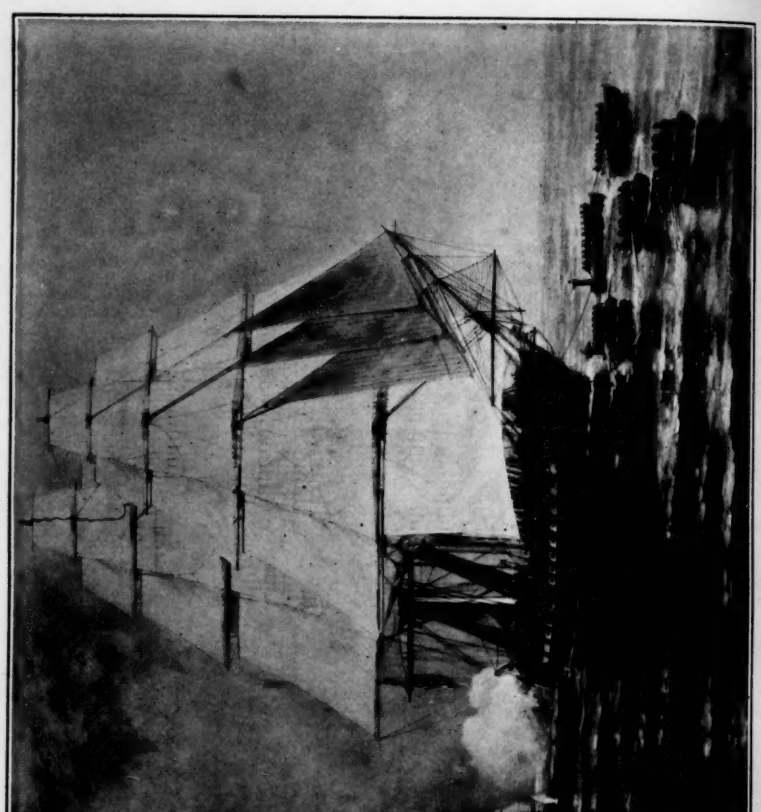

THE CHASE OF THE "CONSTITUTION"

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THE NAVY AND ITS AIR REQUIREMENTS

BY MIDSHIPMAN (NOW ENSIGN) J. A. LAHN, U. S. NAVY

"Methods and means are ever changing,
but fundamentals remain constant."

EDITOR'S NOTE: This paper was awarded the prize in the Henry Van Dyke Prize Essay Contest for the best essay upon a professional subject. The contest was open to midshipmen of the first class of the U. S. Naval Academy.

WITHIN the past few years, the problem of our national defense has been a matter of much discussion and investigation. Two outstanding factors, the Navy and the air, have been brought to the attention of the nation. A similar problem has occupied the attention of European governments, notably Great Britain. In her case a solution was found, but the outcome has far from coincided with the expectations of the proponents of that solution. The British Air Ministry will be dealt with more comprehensively in a later paragraph. It is the intention of the writer to render a brief exposition upon the more important considerations as the basis of the relationship between our Navy and its air force.

Let us briefly recall to mind the purpose that dictates the existence of our naval establishment. The purpose of the Navy is threefold: (1) To insure the defense of our shores against foreign aggression. (2) To guard our legitimate interests on the high seas and in foreign lands. (3) To sustain our national policies. The furtherance of this mission demands preparedness, and when the necessity arrives, the Navy seeks to destroy the

naval force of the enemy. The nature of the Navy's preparedness is embodied in the meaning of fleet efficiency.

Fleet efficiency demands several things: (1) A well-balanced fleet must be composed of a proper number of all types of warcraft possessing distinctive combative advantages. (2) The possibilities of each type must be developed to the highest pitch, and fullest proficiency exercised in its employment. (3) Insofar as it is practicable, the vulnerability of each type must be adequately covered and denied the enemy, to the end that its usefulness as an arm of the fleet be not impaired. Hence it is seen that fleet efficiency is based on the interdependence and proper coordination of the various arms of the fleet.

The most important consideration is the fact that our entire naval structure is embodied in the meaning of unity. The fleet is under one commander; the personnel is trained under one system; there is a single doctrine; the material and personnel are adapted to one purpose; there is a single code of strategy, and a single code of tactics. These considerations are of axiomatic importance and are substantiated by naval history. They are fundamentals, and not susceptible to change regardless of such improvements as take place from time to time in methods and means of waging naval war. It is in view of these fundamentals that the idea of an independent air service is basically unsound.

It is desirable to indicate that in order to emphasize their contentions, the proponents of an independent air force have spared no efforts towards decrying the worth of a navy in general, and the capital ship in particular, this notwithstanding the government's adoption of a policy which clearly upholds the need of a powerful navy. A notion exists that the construction of the capital ship is bounded by fixed and immutable considerations involving essentially obsolete methods of fighting, and blind to the radical changes brought about by the possibilities of aircraft.

It is needless to recall that the capital ship was similarly abused when imaginations were fired with the possibilities of small craft capable of launching the deadly torpedo. The successful operation of the submarine brought with it a storm of protest against the vulnerable, bulky, expensive, capital ship. In the case of the torpedo boat, and again of the submarine, conservative opinion prevailed. It is not contended that conservatism is infallible, but

it is, in the long run, more reliable than the impracticalities of flagrant imagination, and especially the imagination of those who have no direct concern with naval operations.

The designation "capital ship," is applied to a vessel that possesses the most powerful offensive and defensive powers. This designation, wrongly interpreted by the Disarmament Conference of 1921, is not confined to certain qualities to the exclusion of others. At present, the dreadnaught is the capital ship because she can deliver and receive, without permanent disability, the most powerful blows. A submarine can become a capital ship: (1) If she can fire underwater projectiles with greater speed, volume, and accuracy than the gun salvos of a modern dreadnaught; (2) if she can develop defensive qualities that surpass those of the dreadnaught; (3) if her range of vision, speed, endurance, and meneuverability can encompass those of the dreadnaught. Similarly, the seaplane can become the capital ship when the requirements are fulfilled. The capital ship is essentially an adaptation of the most potent form of offense and defense that can in conjunction with the auxiliary, but not the less important, arms, fulfill the mission of the fleet. At the present time, the numerous investigations by competent authorities have resulted in the conclusive opinion that the dreadnaught of today is the capital ship. Due regard has been given to the indispensibility of aircraft and submarine craft. The importance of neither has been undervalued. The fleet that includes dreadnaughts in addition to its airplane carriers, submarines, and other auxiliaries, is properly accredited superiority over a fleet of equal tonnage but lacking dreadnaughts. In the report of the Joint Board to the Navy Department, dated August 18, 1921, it is stated: "Airplane carriers are subject to attacks by vessels carrying guns, torpedoes, or bombs, and will require as all other vessels require, the eventual support of the battleship. . . . . The development of aircraft instead of furnishing an economical instrument of war leading to the abolition of the battleship, has but added to the complexity of naval warfare." From the foregoing, it is obvious that the capital ship is the battleship, and upon her depend the potentialities of the other fleet arms.

It is pertinent to mention the battleship bombing experiments that have been conducted within the past few years. Defenseless

hulks were anchored off the Virginia Capes and airplanes dispatched to bomb them. Before releasing their bombs the aviators expended the better part of an hour determining atmospheric conditions, adjusting sights, and choosing the most advantageous methods of approach. Bombs were dropped from altitudes between 1,100 and 5,000 feet. Conclusions were drawn and on the basis of these, the dreadnaught was declared obsolete. To the writer, the alleged object of these bombing tests was not precisely understood. That airplanes could fly over water was not to be doubted. That bombs could be released was equally well known. That the explosion of a heavy powder charge was injurious to the water-tight integrity of a ship was amply demonstrated during the past war. What difference would there have been had these hulks been sunk by torpedoes, bombs, or gunfire? It is not very apparent how a relevant conclusion could be drawn from a test that was conducted with no attempt at simulation of even the most elementary characteristics of sea battle. What would have happened had the target steamed with frequent changes of course at twenty knots? To what degree would the bombers have been able to reach their objective had they been encountered by a protecting pursuit squadron? These and many more questions challenge the validity of the conclusions that the quick thinkers have formed. Because bombs dropped by airplanes were the cause of destruction, there are those who have already relegated the battleship to obsolescence, and declared our salvation wholly dependent on aircraft. Had these hulks been used for target practice by destroyers, the sinkings would have occurred. Yet no one contemplates substituting destroyers and submarines for our battleships.

Let us consider the Navy and its relation to an independent air force. This is important in view of the fact that there are those who believe in the maintenance of our Navy, but think that its air arm should be under the control of a separate organization that is dealing with a means of waging war essentially different from and independent of military and naval operations.

An impression prevails that the strategical and tactical requirements of aviation are incorporated in a single form that can be readily applied to both naval and military operations. There are those who erroneously believe that machines built for military

purposes can be used to fulfill the requirements of naval aviation. Many are of the fallacious opinion that both naval and military aviators can be trained under one system in view of the exact similarity of their duties. It is on the basis of these considerations that the need of an independent air service is emphasized. Through an organization of this nature, it is believed that the wasteful expense of duplicate control and operation, as is at present allegedly the case in the army and navy aeronautical administrations, can be eliminated; also, an organization of this type will give an impetus to the development of aviation in view of the secondary status to which it is allegedly relegated by the Army and Navy. Let us consider these points, commencing with the strategical and tactical question.

In fleet operations, long distance reconnaissance is of primary importance because it determines the strategical developments prior to contact with the enemy. No better instance need be given than the plight of Admiral Jellicoe when he was unable properly to form his strategic lines because of inaccurate and insufficient data from his reconnaissance forces. Though fundamentally of the same root, sea reconnaissance differs widely from land reconnaissance in the practical applications. "Differing from land operations in which the airman is dealing with a comparatively stationary phase, the naval airman has to develop his attack on, or to furnish reports of, objects which themselves are moving and are endowed with high maneuvering capability."[1] The location of the enemy, a full knowledge of his strength, the identification of his important units, the disposition and movements of his several arms, his speed, course, and apparent intentions; all of these are of vital importance to the commander-in-chief. To what extent can the situation be properly analyzed, the data concisely and accurately formulated, and rapidly transmitted, when the personnel engaged in this work lack the naval understanding and the naval judgment that are the results of naval training? The fleets have made contact and now the tactical functions of aircraft are brought into play. They are briefly: (1) To spot the fall of shells. (2) To deliver torpedo, bomb, and gas attacks upon the airplane carriers and dreadnaughts of the enemy. (3) To protect

[1] *Brassey's Naval Annual, 1925*, page 90.

the spotters and clear a way for the bombers. (4) To protect the fleet from similar efforts on the part of the enemy. (5) To scout the movements of the enemy's different arms. Can these duties be efficiently performed by aviators who are practically ignorant of ships' movements and ships' gunnery methods? Obviously so far as the strategical and tactical requirements are concerned, naval training is of immense importance. Where can such training be conducted more efficiently and more expeditiously, in the Navy or in an independent air service?

The question of air personnel is analogous to the nature of the fleet's air requirements. The fleet aviators in order to possess the requisite knowledge of and experience in naval strategy, tactics, gunnery, and maneuvers, must be essentially naval men, for there is very much to learn, perform, and perfect in these respects. Proficiency, accuracy, and precision are gained only through years of intensive exercise and coordination with the other arms of the fleet. These requirements are not adequately fulfilled by a hurried course of instruction that will at best merely familiarize men with the general nature of fleet air work. We cannot with reason train a body of men under one organization, dispatch them to several months' duty with an organization of an entirely different nature, and expect all-round performance of a maximum quality. A land flier assigned to fleet duty has too much to unlearn of his old sphere and too much to learn in his new sphere of activity to warrant any appreciable degree of usefulness.

We must not lose sight of the fact that we are dealing with a vital arm of our fleet. If the fleet air arm is deficient because of the character of its personnel, its lack of indoctrination in fleet ways and methods, its lack of "the sea sense and the sea understanding,"[2] then the efficiency of our fleet is bound to suffer; for without the control of the air prior to and during action, our fleet is worthless.

Let us now turn to the consideration of naval air material. People are of the opinion that aircraft built for military and naval operations are of similar design and construction. Of course, aircraft for all purposes are built under common fundamental physical principles that involve sustentation, mobility, and control.

[2] *Brassey's Annual*, page 83.

But aside from the fact that every plane possesses wings, engine, fuselage, rudders, and landing gear, the similarity no longer exists. "It is to be observed, however, in this connection, that aircraft for use for naval purposes differ in many essential respects from aircraft used for military operations, that spotting, reconnaissance, and torpedo machines are types peculiar to the Navy, and that the development of these types to meet sea conditions, including their housing on board aircraft carriers, cruisers, and capital ships is largely a naval problem in which sea knowledge and sea experience are necessary.[3] It is evident from the foregoing that the independent air service will have to consult the Navy. But the mere consultation does not insure the efficiency of the fleet air force because the Navy's recommendations in this respect are not mandatory and the air service can adopt them or not as it sees fit. It is stated that the control of all air forces vested in a single department will further the development of aviation to a more rapid extent than is now the case with the Army and Navy in separate control of their air arms. How this is practically possible is not very apparent for several reasons: first, the air service will at once be concerned with developing material for two air arms, each essentially different in every respect from the other; second, the interdepartmental comity that exists between the Army and Navy aeronautical boards furnishes a means of exchanging ideas. Where one accomplishes a notable improvement in the construction of a plane, the other is welcome to any advantages that it may derive from such improvement. This is similar to the relations between the ordnance bureaus of the two services. Obviously competition exists, but we know that ".... an element of competition in certain matters has its advantages." Third, the staff of technicians working under the supervision of the Naval Bureau of Aeronautics has proved itself as capable as any similar staff in the world, and more so than the staff employed in the country that possesses an independent air ministry.

The creation of an independent air force will inevitably bring with it a divided responsibility for the efficiency of our fleet. The proponents of such a department contend that the efficiency of the fleet will not suffer because of the cooperation that will exist

[3] *Brassey's Annual*, page 91.

between the Navy and the air service. It is, therefore, upon the factor of cooperation that the efficiency of our fleet will depend.

The word "cooperation" is a source of pitfalls when admitted to military and naval operations. It possesses an implied meaning, but for practical purposes, it is the equivalent of meaningless for the principal reason that it denotes concurrent action by individuals or groups possessing equal rights. Obviously, the degree of concurrence and coincidence in matters of doctrine, policy, and opinion, is subject to the individual human traits and susceptible to the old adage, "no two men think alike." Cooperation in its very essence invites dissension, hesitation, and multiplicity of doctrine. To introduce even the possibility of their occurring in any phase of command, control, or training of our fleet is ruinous. We ought to know that the harmonious adjustment of the command and training of naval units must be of a subordinative nature, and emanating from a central authority. History is replete with instances that prove the inconsistency of a system involving dual control and dependent upon cooperation. Unity of command, unity of operation, and unity of doctrine, are the proven requisites of an efficient naval organization. Yet there are those who cannot see that, where two chiefs are assigned joint control over a fighting arm that is essentially a component part of the fleet, efficiency is bound to suffer and disaster is invited.

Let us briefly review the history and present status of the British Air Ministry. Under the exigencies of the war, several ministries were created to meet the gigantic emergencies that arose to a great extent through lack of adequate preparedness. The construction and supply of aircraft was assigned to an air ministry. Creditable work was accomplished, and on the basis of this, the Air Ministry resolutely disputed all steps at its dissolution when the war ended and the military and naval establishments were being reduced to normalcy.

The following statements from an article by Sir Herbert Russell are relevant to a great extent on the course pursued by the Air Ministry to uphold its existence.

> The new Ministry of Air proclaimed that it had done much invaluable work during the war, which otherwise would not have been done at all, that it had justified its claims to a permanent existence in the scheme of national defense. . . . . The long controversy between the Admiralty and

the Air Ministry is a matter of general knowledge. . . . . The Air Ministry realized that it had become a fifth wheel upon the coach, but it had made up its mind to fight for continued existence. So it began to usurp authority over civil aviation. . . . .

Commercial aviation is essentially a matter of private enterprise. If the airship is a profitable proposition for the carriage of passengers or freight, private enterprise would build her fast enough. But the airship is not a profitable proposition; private enterprise leaves her severely alone, and the Air Ministry exploits her so as to persuade the public that it is doing a national service.

We are treated to a lot of talk about "imperial airways," "linking the empire," and so forth by this ministry which continues to cling to office so resolutely. But the simple fact remains that all this heroic terminology is mere eyewash to sidetrack perception of the fact that the Air Ministry is merely butting in upon private enterprise. . . . .[4]

At all events, the Air Ministry minority staged a powerful fight, and the ministry remained, but not without concessions which have to a great extent altered its character and lessened its independence. To preserve the unity of command in the British fleet, it was decided that air personnel embarked on ships of war were subject to the Naval Discipline Act and therefore under the orders of the commanding officers of such war vessels. To safeguard the necessary character of personnel serving with the fleet, provisions have been made whereby seventy per cent of the aviators for use in the fleet air arm are to be naval personnel. Land artisans and mechanics formerly on board the aircraft carriers have been replaced by shipwrights and naval mechanics. In the construction and design of aircraft for use in the fleet, the recommendations of naval advisers are to be considered, though no obligation other than the mere consideration is attached. These foregoing concessions have radically altered the status of the British Air Ministry since its definite establishment as a permanent ministry in April, 1923. But despite these changes, Britishers continue to voice their disapproval of a system "where there exists within the navy a service separate from the navy, a service with different conceptions and different traditions, a service looking to an authority independent of the Admiralty for its upkeep and preferment."[5]

[4] U. S. Naval Institute Proceedings, January 1926, page 138.
[5] *Brassey's Annual*, page 83.

British inventive capacity from the naval viewpoint has always held its own with American technic in this respect. But we cannot help noticing that since the Air Ministry took control, very few aviation records have been won by Englishmen, nor has there been any commendable improvement in methods and means of accommodating aircraft on board the British capital ships and cruisers.

A major item which merits our interest is the economical question of the British Air Ministry. The proponents of an independent air force argue that the duplication of effort, as is the case at present, involves a considerable wastage of funds; that with a separate air department in control of all the air activities, this needless waste would be eliminated. This is not the case with the British Air Ministry, nor can it be possible under any system where three departments are detailed to do the work of two. The law of mechanical efficiency is applicable in this respect. The creation of the British Air Ministry has necessitated more housing facilities, more swivel-chair experts, more uniforms, more administration over a problem of national defense that is already over-ridden by the machinations of politics, and withal a greater resultant wastage in funds, not to mention the discontent with this system that is prevalent throughout Great Britain. It is not predicted that an immediate fall is in sight for the British Air Ministry for the reason that in peace times, political irregularities have a way of superficial adjustment that tends to quiet agitation.

In concluding, it is fitting to mention the underlying fault, the *dual control,* that is unavoidably connected with the existence of an independent air force.

The Navy is responsible for its fleet. The proposition is to organize a separate department and give it control of the fleet air arm, an integral arm of the fleet. Would this not be the equivalent of placing the control of the submarine arm, or the fleet train, under a separate department? The analogies are identical and not exaggerated. The commander-in-chief is held to account for the outcome of the battle. He is responsible for every phase and every evolution through which the component arms of the fleet are exercised. Is this accountability reasonable when the air arm of the fleet is not under his command, or

its training is conducted under a system essentially un-naval?

We must not let our imaginations carry on to the extent of violating the fundamental principle, unity of control. Our adherence to that principle does not compel us to support old and obsolete methods and means, nor does it preclude us from incorporating to our best advantage the possibilities of aircraft. The sea menace exists and can be met most effectively by our Navy provided it exercises complete control in the maintenance, training, and operation of its component arms. The air menace to our centers of production is possible and can be met by the air forces of our Army. Let us study the mistakes that others have made, and profit by them, for it is through lessons of experience that fundamental principles are best substantiated.

THE DETERMINATION OF THE COMPASS ERROR

A Simple Method of Obtaining Compass Deviations When the Ordinary Means Are Not Available

By Commander G. T. Rude, U. S. Coast and Geodetic Survey

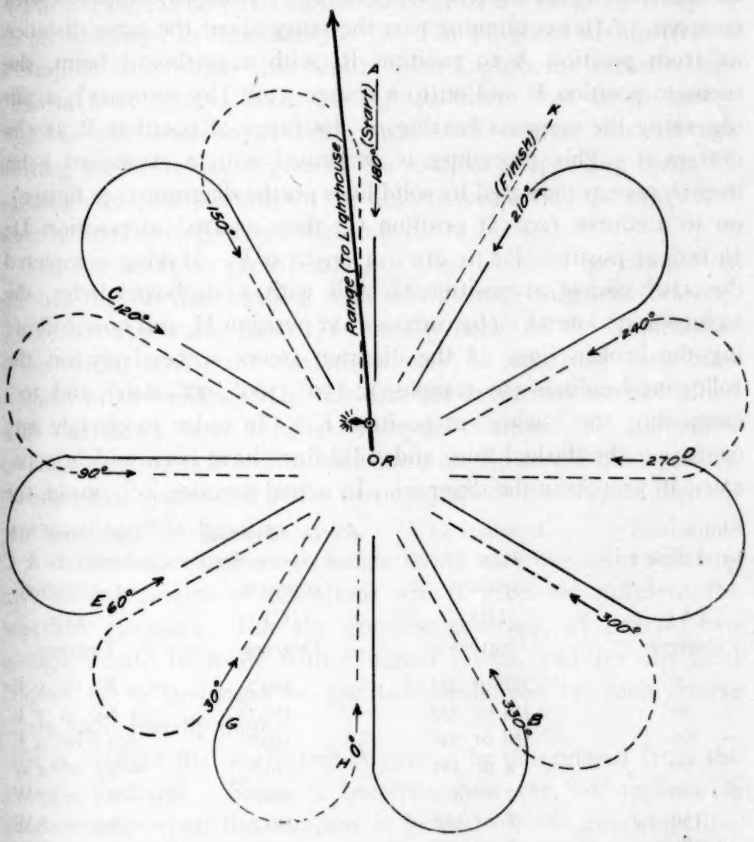
STANDARD books on navigation describe several methods for determining the compass error—by reciprocal bearings, requiring a station on shore; by bearings of the sun, requiring a clear day; by ranges, requiring that the magnetic bearing of the range be known; and by a distant object, requiring the object to be at a considerable distance from the ship. The following "gadget," not described in books on navigation, so far as is known, proved of value to the writer. In a sense it combines two methods, the bearing of a distant object and a range; except in the way employed, the "distant object" need be only a *few* miles away and the bearing of the range need not be known; in fact, the two objects comprising the range need not even be charted.

This method is confined to the determination of deviations of compasses in the fore-and-aft amidship line, when the distribution of magnetic metal to starboard and port is fairly symmetrical. Since practically all compasses are so placed, the method may be regarded as universal. It is not confined to any size vessel except that it may prove time-consuming on a slow-turning vessel of long turning radius. The writer employed the method with very satisfactory results on a vessel 250 feet in length, but it can be used on larger vessels.

The vessel steamed successively on twelve headings (on every alternate 15° rhumb) across the range of Smith Point Lighthouse, Chesapeake Bay, and the lighted buoy six and one half miles to the southward. The bearing of this range, a few hundred yards to the southward of the buoy, was obtained on each heading by pelorus compared with the standard compass. For the accepted correct magnetic bearing of the range the average of all the

compass bearings was used. The deviation on each heading was then obtained by a comparison of the compass bearing of the range on that heading with the mean magnetic bearing of the range obtained by averaging all the compass bearings.

The method was conceived rather from necessity than choice. It has the advantages, however, that it can be used at any time



when terrestrial objects are visible—in clear or cloudy weather, during the day or night. It can also be varied according to circumstances. During the day a flag buoy may be anchored and the vessel "swung" with that in range with a lighthouse or headland, or another vessel at anchor in range with a lighthouse or with any natural object; at night a lantern on a small boat at anchor may

be used in range with a light, none of which need be charted objects.

The "swing" can be made without maneuvering the vessel with the engines (See figure). The vessel can begin at A, with the lighted buoy a few degrees off the bow, and head 180° (south) by compass. As she passes the range at position R the bearing of the range is observed by compass or by pelorus, compared with compass. After continuing past the range about the same distance as from position A to position R, with a starboard helm, she turns to position B and on to a course 330° (by compass), again observing the compass bearing of the range at position R as she crosses it. This procedure is continued with a starboard helm in each case as indicated by solid lines on the diagram (see figure), on to a course 120° at position C; then to 270° at position D; to 60° at position E; to 210° at position F. Having completed the 210° course at position G, still with a starboard helm, she swings to 0° (north) (by compass) at position H, and now following the broken lines of the diagram steers successively on the following headings (by compass); 150°, 300°, 90°, 240°, and 30°, completing the "swing" at position K. (In order to obviate any confusion the dashed lines and solid lines have been widely separated in preparing the diagram. In actual practice, of course, the

Ship's head by compass	Bearings of range by compass	Average bearing of range by compass	Difference of columns B & C or deviation
(A) Degrees	(B) Degrees	(C) Degrees	(D) Degrees
0	351 or 351	359.7	+8.7 or 9 E
30	353 or 353	359.7	+6.7 or 7 E
60	358 or 358	359.7	+1.7 or 2 E
90	4 or 364	359.7	−4.3 or 4 W
120	7 or 367	359.7	−7.3 or 7 W
150	8 or 368	359.7	−8.3 or 8 W
180	8 or 368	359.7	−8.3 or 8 W
210	7 or 367	359.7	−7.3 or 7 W
240	3 or 363	359.7	−3.3 or 3 W
270	356 or 356	359.7	+3.7 or 4 E
300	352 or 352	359.7	+7.7 or 8 E
330	349 or 349	359.7	+10.7 or 11 E
Average of bearings by compass	359.7		

two systems of courses on opposite headings represented by these lines may cover practically the same ground.) The vessel has now headed successively on the following compass courses in the order named: 180°, 330°, 120°, 270°, 60°, 210°, 0°, 150°, 300°, 90°, 240°, and 30°, with the following compass bearings of the range on the different headings.

The average is taken of all the bearings of the range by compass on all headings, in this case 359°.7. For purposes of illustration it may be unfortunate that Smith Point Lighthouse actually happens to bear 359°½ from the lighted buoy; that is, so nearly 360° or the whole of a circle; while, of course, this average bearing might be any degree of the compass, depending upon the actual geographic positions of the objects comprising the range and their actual bearings from each other.

The deviation on each heading is then obtained by comparing the bearing on that heading with this average magnetic bearing. These deviations are plotted, as usually done, on the Napier diagram, from which the deviations may be taken by inspection for any other headings. In this case the deviations were obtained with the ship's head on given compass courses. The deviation on each heading is therefore laid down on the *dotted* lines passing through that graduation of the vertical scale of the Napier diagram representing that heading.

As under other methods, a single swing with one helm will furnish determinations of deviations with a precision sufficient for practical purposes. For the greatest accuracy, of course, two swings should be made with different helms, and for the final Napier curve the mean of the two deviations on each course taken, as is usually done.

It is realized that coefficient A cannot be determined from the swing illustrated. Since A becomes, however, of appreciable amount only when the compass is located off the amidship line, or for some like cause, its value is usually so small that it may be neglected for all practical purposes, or its value from a previous swing may be used.

BETTER PREPARATION FOR WAR

By Captain A. W. Hinds, U. S. Navy

ONE of our younger officers, who was a destroyer commander "over there" during the war, told me two short stories of a British destroyer commander that illustrate our need to call to mind occasionally Bobby Burns' lines:

> Oh! wad some power the giftie gie us
> To see oursels as others see us.

The British destroyer commander—"B. D. C.," I'll call him for the sake of brevity—was aboard one of our destroyers where he saw a typewriter. He inquired all about it, how it worked, what it cost, etc., and then told the American commander he thought he'd get one for his boat. The American commander warned him against the typewriter and explained that it would get him into all kinds of trouble, but B. D. C. left the ship with his mind made up to get one of the machines "come what may."

A few months later the American commander was aboard the British boat, saw a new typewriter on the desk in B. D. C.'s cabin and asked if it had gotten the Britisher into any trouble. "Oh! no," replied the latter, "you see I have no one aboard who knows how to work the blinkin thing."

The foundation of the other story was laid at the club where the two commanders were finishing up a three or four days' sleepless escort trip. *In vino veritas*—as the good old saying goes—and B. D. C. was telling the American how the British would lick the United States in case of war.

"Why you Americans would be easy marks," said B. D. C. "All the British Empire would have to do would be to declare war and keep its Navy at home six months and the American Navy would work itself to death."

The two little incidents given above amount to nothing in themselves but they do indicate that the British Navy, which has been

very successful for three centuries, takes its troubles less seriously than does the American Navy.

Just now the Navy is approaching the position it held in the hearts of the taxpayer shortly after the Civil War—along in the seventies and up to the late eighties.

Unquestionably the Navy, by closing the Southern ports to arms and ammunition and by splitting the Confederacy in two, when it held the Mississippi River, was the vital factor in winning the war. Yet, in the early eighties the number of naval vessels had fallen so low that many of our most energetic naval officers had to seek positions in the merchant marine. In the early nineties I can remember when a new ship went into commission the captain had not been to sea in eight years, and both the executive and the navigator had been on shore duty for seven years.

There are several reasons why the writer feels strongly that the Navy is in for lean appropriations with probable drastic reductions. First is the idea—born of conceit—Americans have that this country can lick the earth with little or no preparation. The Continental Congress labored under the same delusion, when Washington, during the terrible winter at Valley Forge, spent most of his time writing pathetic appeals for "regular" troops.

Even with respect to an intensely complicated profession like the Navy few "average citizens," who think of the matter at all, realize that a navy can not be prepared for war in a short space of time. They have never had it brought close home to them, that in order for the Navy to make good against intelligent enemies it must be kept absolutely up to date and that its officers must work day in and day out, year after year, with a never flagging enthusiasm.

Another reason a reduction in the Navy is to be expected is that other countries have not the money to support the present-day navies. They must cut because they can not afford to pay the tremendous amounts the modern well-balanced navy costs.

The great majority of voters, and they, after all, are the main spring behind congressional appropriations, look at the matter, I think, in about this way. They feel that other naval powers can not "pay the fiddler" at the rate navies are going and that the United States can afford to reduce its naval expenses along

with the others and still be safe in the event of war. In this they are probably right as long as our representatives at reduction conferences play safe in practice and make sure we are equal, type for type, with any other naval power. Incidentally there is one point these representatives should always bear in mind and that is that (qualified by lack of naval bases) the power the United States exerts overseas will be in direct ratio to the comparative strength of the Navy.

It does not require unusual brilliance to recognize that Japan, for instance, exerted great influence both at the treaty making in Paris and at the Limitation of Armament Conference in Washington; and that China, with nearly eight times the population of Japan, had no influence at all. Why? Simply because Japan had efficient armed forces and China had not.

Another force tending toward further reduction in navies in the near future is that smaller, but more outspoken, party of voters who honestly, I dare say, believe the millenium has come and that there will be no more war.

These take no stock in the world-old theory that commercial wars have always engendered national hard feelings. They can not understand that we, in the United States, are at present a little worried because the British control the rubber industry. This class does not look far enough ahead to see that America has just about arrived at a point where we must sell, outside our own country, some of the products of our industries—and on an increasing scale—if our workmen are to keep up the present high scale of living. Nor can they visualize Europe returning to normal industry and making a bitter fight for the markets we *must have* if the nation is to make progress.

So, for the reasons given above with the resultant pressure on Congress, and with the President in favor of it, it does seem that further reduction in the U. S. Navy is almost certain, and that naval officers must trim their sails to meet the oncoming blow.

The reduction of the Navy to a point where it can not fight *successfully* in *any* ocean to carry out any policy our statesmen may desire to enforce now, or may desire to enforce in the future, really leaves the responsible naval officers in a parlous state. To illustrate: suppose, for instance, the United States should give up the Philippine Islands. It is not difficult to imagine some other country finding an opportunity to quarrel with the weak

Philippine government. The result would be a foregone conclusion—with another flag replacing "Old Glory" over Manila. How would this affect the peace-loving inhabitants of the United States? What newspaper headlines there would be—covering almost the whole first page as they did at the opening of the Spanish-American War! What waving of the "red, white, and blue" all over the land! What a furore in Congress!

Under such pressure would the commander-in-chief of the U. S. fleet be permitted to delay and prepare a little better for the overseas movement because our diplomacy has left us with no naval bases in the Western Pacific? Hardly—if he held out for delay in sailing his shift would be about as short as that of General Johnston at Atlanta when his ideas of strategy did not agree with the policy of the Confederate Government.

There is little or nothing the naval officer can do with respect to the policy of further reduction of naval armament. He can advise as to the strategic value of this or that type of fighting craft and, no doubt, there will be naval officers detailed to advise our representatives at forthcoming conferences.

Once settled as to number in type of ships to be retained the whole question removes itself beyond reach of the naval officer. Then his duty becomes that of assuring maximum efficiency of the ships retained in the Navy. The question he must ask himself and answer conscientiously is—are we learning to make the most hits on enemy ships per dollar appropriated?

Suggested Improvements. There are so many wiser heads than mine that I feel somewhat presumptuous in making even a short list of the mistakes I believe we are making in preparation for war. The list will be very short, however, and what may be called "criticisms" will be made as constructive as possible; where I can suggest the remedy I shall do so although my answer may be entirely wrong; where I can suggest no answer I shall say so.

Complicated Tactics. At a conference of officers at the end of the fleet maneuvers in Hawaiian waters the subject of manuals, books, secret tactical instructions, etc., was brought up.

The writer, with the assistance of other officers, made a list of the publications and letters the *alert* officer-of-the-deck needed on the bridge during fleet tactical exercises. We made separate lists and came to the compromise conclusion that a "baker's dozen" was the correct number!

Evidently the poorly arranged tactical manuals had been a matter of some concern to the commander-in-chief for he spoke of it at the conference and when he promised to use his influence to have our tactical manuals simplified he was roundly applauded. The applause, to my mind, shows there is something wrong—possibly we are trying to crowd more than can be crowded into one brain.

In any case when one tries to visualize what will happen in war—the great dilution of the officer personnel by reserves and volunteers who have had little training—it is certain that we must hang on like grim death to simplicity or seriously consider specialization.

Not only are our books poorly written but I believe our tactics are unnecessarily complicated. The battle formations are simple, easy to remember and are necessary, all of them—but why have so many cruising formations? Taken "full and by" simplicity is probably the most vital principle in successful tactics.

Let us compare the effect of few and many cruising formations. Suppose we have only two, one for high and one for low visibility, and call the battle formations A, the cruising formation for high visibility B and that for low visibility C. We shall assume that, to do these maneuvers well enough for use in approach to battle, officers—from the admiral down to the junior watch—must know the maneuvers practically "by heart." With only two cruising formations then officers will have to learn *thoroughly* how:

(1)	To go from A to B and A to C.....	2 maneuvers
(2)	To go from B to A and B to C.....	2 maneuvers
(3)	To go from C to A and C to B.....	2 maneuvers
	Total to learn.....	6 maneuvers

Suppose now our cruising formations are increased to, say, four. Call the battle formations A and the cruising formations 1, 2, 3, and 4; officers must learn:

(1)	To go from A to 1, 2, 3 and 4.....	4 maneuvers
(2)	To go from 1 to A, 2, 3 and 4.....	4 maneuvers
(3)	To go from 2 to A, 1, 3 and 4.....	4 maneuvers
(4)	To go from 3 to A, 1, 2 and 4.....	4 maneuvers
(5)	To go from 4 to A, 1, 2 and 3.....	4 maneuvers
	Total to learn.....	20 maneuvers

Now considering the ramifications introduced by only a small increase in the number of battleship cruising formations illustrated by the preceding tables the following points must be borne in mind:

(a) The maneuvers leading from cruising to battle formations and vice versa are not simple. Diagrams must be looked up and tables consulted if we wish to do these maneuvers properly as we must do when approaching the enemy for battle. How much easier to learn how to do six maneuvers than twenty! And consider how much better we shall do them.

Vice Admiral von Scheer was able to go "ships about" when under fire of the enemy—a maneuver I have heard many high ranking naval officers speak of as "impossible." The German fleet did the maneuver successfully under fire because it had practiced at it many times; it *must* have done so to be able to perform the maneuver successfully under heavy gunfire!

(b) Our captains, executives, navigators, and watch officers have no doubt the keenest desire to be thoroughly posted on *all* maneuvers. When one considers all the other things these officers are required to crowd into their brains, can they carry them all with any degree of success unless the whole naval profession is kept boiled down to the lowest order of simplicity? In this connection it must not be forgotten that both captains and executives have short tours at sea—the executives' tours too short to do more than become acquainted with the ship before detachment.

(c) In addition to having more cruising formations than the writer considers necessary on account of various conditions of visibility there are other formations to cover special cases where the enemy is within certain bearings, etc. Are we not trying to "paint the lily"?

(d) The cruising formations referred to above are those of the battleships, which are our "main point of support" and will probably remain so until the aviators prove that surface craft are no longer needed in war. So if there are many cruising formations of battleships there must be a correspondingly large number of formations of destroyers, submarines, light cruisers, aircraft carriers, etc.—for as long as battleships are considered to form the "backbone of the fleet" all other types must cruise in certain relative positions to the battleship formation. It is also true that, for proper coordination, all officers on all types of

warships must have a fairly accurate knowledge of the tactics of each type; so there is the same need, for instance, for cutting the number of destroyer and other formations "to the bone" as there is for keeping the number of battleship cruising formations at the lowest practicable limit.

The writer is not sufficiently familiar with destroyer tactics to judge whether they can be much simplified; furthermore it would be impracticable to go fully into the tactics of the various types in an article of reasonable length—nor could one do so without giving away confidential matter. I have been informed, however, by at least two destroyer squadron commanders that our present destroyer tactics could stand much simplification.

The main point is that all formations not necessary in war should be eliminated from our manuals. We know we are going to have to economize rigidly in the near future—even on money for fuel for maneuvers—so should we not delete our manuals of everything except the few maneuvers we shall use in war and perform these few maneuvers over and over again during time of peace so we may do them well in time of war?

Theoretical tactics must, of course, be tested out practically at sea and occasionally we have tactical boards of seagoing officers formed to go over the whole tactical situation to boil down and simplify. Two years or so ago we had such a board and its members represented all types of naval fighting craft. The composition of the board seemed ideal—but the trouble was then and always will be that no board of seagoing officers has time enough to prepare the simplest and best tactical manual. There are too many routine duties to interfere with that uninterrupted thought which is necessary to do the work carefully as it must be done.

About 200 years ago a Scotch civilian, John Clerk, wrote a treatise on naval tactics that was successfully used by Nelson and other naval leaders during the wars of the French Revolution. It is difficult to imagine a civilian writing a book on naval tactics but Clerk was intensely interested in the subject and he had ample time to give it undisturbed thought. In addition Clerk had many friends in the navy who helped him by criticizing his tactics with the result that he produced a book of practical value.

It would be absurd to suggest that a civilian simplify our present tactical manuals for us but it is far from absurd to state that

no board of officers doing sea duty can ever find the time to do this work. We all know, anyway, that no matter how big a board is, in point of numbers, it is generally a "one man" board. Ideas may come from all the members but one man generally collects them and writes them up, so why not have a small board on tactics—on shore duty with nothing else to think about—with orders to see how much we can afford to cut out of our present tactical books?

I doubt whether even our most brilliant officers can remember all the maneuvers we have in the books now and in the excitement of approach to battle, with bombs and torpedoes to distract us, I am not certain the most phlegmatic officer could find the right diagram in the right book. If we had so few maneuvers that one could remember them then the probabilities are that we could maneuver correctly even in an actual battle approach.

Communication Troubles. I believe that many of our high ranking officers are frankly worried over the ever-increasing number of men and officers assigned to communications aboard ship. This may be due to the natural conservatism that comes with age—but the senior officers have seen the communication detail grow on battleships from, say, eight or ten men in signals to four times that many and from about four in radio to as high as thirty and this at a time when there is not room aboard ship for the increased number of officers and men without living in extreme discomfort.

As our business as naval officers is to see that the Navy is *kept prepared* for war, it is apropos to examine the naval communication work of the World War, briefly, of course, as must be done in an article of reasonable length, and try to measure its importance and estimate whether pressure to increase communication details can be resisted with safety. With this in mind some study was made of the official dispatches of the Battle of Jutland. Taking "messages" to mean communication other than by letter and covering the time from midnight of May 30 to 9:00 P.M. May 31, the total number of messages sent and received in the British fleet was 1,502. This was at the rate of a message—either by radio, or a signal by flags, semaphore, or searchlight—about every eight-tenths of a minute.

Of the above messages 159 were sent by radio—a message about every 7.9 minutes.

From the time of first contact with the German fleet, at 2:20 P.M. May 31 to 9:00 P.M. (practically the end of main body action), the radio was much busier than before contact. During this period there was a radio message sent, received or intercepted about every 3.3 minutes.

Coming back now to the importance of these messages it seems to the writer that the serious radio messages in connection with this battle were:

(a) Information concerning probable movements of German fleet.

(b) Reports of contacts with the enemy fleet giving changes of course, speed and formation of enemy when these occurred.

(c) Tactical signals sent by radio.

There were, of course, many tactical messages sent by radio; in presence of the enemy this will always be necessary—paralleling flag hoists and semaphore or searchlight signals to avoid misunderstanding in the confusion of battle.

Aside from tactical signals sent by radio, one can see from an examination of the Jutland official despatches that, between 2:20 P.M. and 9:00 P.M. on May 31, there were only about twenty radio messages of major importance. Whether the great number of radio messages reaching the staff of the commander-in-chief during this period—one every 3.3 minutes—caused a jam is not known. If many of them were in code the commander-in-chief must have been seriously embarrassed for, in that case the messages would have had to be decoded before the staff could pick out the important ones. Some of the messages showing enemy position after 9:00 P.M. did not reach Admiral Jellicoe's flagship but a sufficient number did reach the British Admiral to show the positions of the German fleet during the night provided these messages were properly interpreted.

During a great fleet action there is probably as much danger in having too many radio messages reach the flagship as there is in having too few. The reporting of damage, for instance, to individual ships can only be disconcerting as, once in action, assistance should not be rendered to a wounded ship.

If the two main bodies are within sight of each other messages are not needed. If we drill enough in time of peace then we will be able to fight "according to doctrine" in time of war and when

tactics are sufficiently simplified some kind of a "follow the leader" method might even make it unnecessary to send tactical signals. What we shall need to know from the radio is position, formation, course and speed of the enemy and any changes in these, and nothing else should be allowed to go into the air except messages from spotting planes after the battle is on.

During the engagement at Jutland the despatches from the Admiralty were probably of some value to Admiral Jellicoe; but despatches from Naval Operations would be of no value to the U. S. Navy in a great sea fight. We at least hope the fights would be too far away for Operations to give any valuable information as to the position of the enemy—this is *the* matter of importance to the commander-in-chief when near the enemy and nothing else should be allowed to bother him.

History shows that when naval powers are at war their fleets eventually get together—for the mission of each is to destroy the other. The use of scouts merely gives the commander-in-chief advance information which, of course, is a good thing and for that reason there must be a radio frequency for use of the scouting forces. When once the enemy position, formation, course, and speed have been reported the scouting forces should keep quiet until there is some change.

Our experience with communications in war problems at sea has shown a marked tendency toward too many reports with danger of overloading the communication lines of the commander-in-chief. The Jutland despatches show much duplication of reports. This points to the necessity for few and only very important despatches; it also points possibly to only one communication lane when the enemy is within striking distance. Then all hands would know what is going on and could act intelligently as per doctrine. Outside of the one lane what would we need?

Naturally we must have tactical radio lanes if we must parallel visual signals and there must be spotting and scouting frequencies. It is certain, however, that with the spirit of economy in rapid development we must keep our radio details and all other special details to the lowest possible limit. The less money we spend on them the more we shall have available for landing shell on enemy ships when there is need to do so.

There is at present a tendency in the fleet toward too much use of the radio for fleet business where the business could be done

by letter. This is due to a pressure from an expanding radio personnel for practice in radio communications; it is contrary to the spirit of the communication regulations but the radio personnel "get by" with it because so few of our senior officers are posted on the details of radio work.

The habit is bad, for what we do in time of peace will have a strong appeal for us in war. Furthermore it is not necessary, for if we plan efficiently, we can cover most of the messages we send by radio on fleet business by letters.

Practice in radio communications should be obtained through test messages rather than by doing that part of the fleet business which should be done by letter—otherwise we shall find ourselves depending on the radio too much and overloading communication lines in time of war.

Professional Education of Junior Officers. We naval officers have tied ourselves up to the most complicated profession in the world—engineering, radio telegraphy, international law, gunnery, seamanship, navigation, military law, and aviation are, most of them, professions in themselves. Sometimes it seems that the average brain could not grasp them sufficiently to enable the line officer to be an efficient "all round" officer. The British and Japanese Navies still resort to specialization. Our system probably results in better officers in the higher commands—but there probably come times in the minds of the seniors when they doubt whether the pace can be kept.

When the midshipman graduates at Annapolis he has only the slightest smattering of the knowledge needed in his profession. There is no time now for the naval officer to be a "finished French and Spanish scholar" as there was in days of John Paul Jones—there is too much professional reading to do.

In the old days, prior to the modern navy, the best watch officer the writer ever had the pleasure of knowing read the rules of the road and duties of the officer-of-the-deck every Sunday. Perhaps some would not approve of his having done this professional reading at the time this watch officer should have been at church—but the psychology of repetition worked in this case and the officer knew his duties like A B C's. Recently the writer saw one of our war product officers-of-the-deck send for the *Navy Regulations* to look up what honors to give, and when he got

the book he was so unfamiliar with it he did not know where to look for what he wanted.

If it was necessary in 1895 for an officer to read up on this profession an hour a week it is essential now for our younger officers to read an hour a day. Incidentally it would not hurt the older officers to brush up occasionally. One might think it satisfactory for officers to learn by experience and by having to prepare for examinations but it is not—it is too expensive to the Navy. In the fleet there is almost constant criticism, for instance, of the lack of knowledge of the engineer officers of destroyers. Now suppose each of them spent an hour a day on the *Manual of Engineering Instructions;* they would become acceptable engineers in a very short time.

So I believe we must come to about an hour of professional reading every day for every officer, junior to commander, or go back soon to specialization. Our commanding officers will have to put into practical effect Kipling's old saying, "Work him lightly in office or dog-cart—but give him no rest."

Repair Work by the Fleet. The views of naval officers about how much of the fleet's repair work should be done at navy yards are not in accord; some believe that practically all the work should be done at yards, others that the fleet should do everything within the capacity of the ship's force, tenders and repair ships.

It is undoubtedly true that work at navy yards costs many times more than the same work done in the fleet, so, if the writer's prophecy is correct that the Navy is due for a long period of lean appropriations, we can keep more naval power on the sea by having the fleet do all the repair work that it possibly can.

Another factor to be evaluated is that the more repair work navy mechanics do the more they will know about the machinery they have to operate; it is the very best school for them.

The largest factor, however, is in the answer to the question—Would our fleet be used on our own coast or at a great distance from our own coast in case of war? If the fleet is likely to be used at a great distance from our navy yards then it seems to the writer that the only common sense solution is to make the fleet just as nearly self-supporting as possible and thereby do in time of peace what we shall be forced to do in time of war.

Finally—as far as the Navy is concerned—the pendulum is now swinging toward the point it reached a few years after the close of the Civil War when it was so neglected in appropriations that it almost went out of commission. There will, of course, be naval advisers to naval disarmament conferences, but, if the majority of people in the United States believe there will be no more war, the naval advisers will be discredited.

While it may happen that our fleet will be kept equal to the best by the conferences on naval disarmament, yet they may not take into account the fact that the fleet may some time be needed in waters where we have no place to repair or refit, so the fleet may be handicapped in that respect. It should be further borne in mind by naval officers that the American people are the most impulsive people on the face of the earth—bar none. It will make no difference to public sentiment whether the Navy is prepared or whether it has convenient bases in all the seven seas like the British Empire; our history verifies this. When public sentiment says sail—we shall sail to seek the enemy. It therefore behooves us to make every dollar count to the utmost toward an efficient Navy and to prepare ourselves by study and drills as never before; the greatest aid to this is to keep as much simplicity as possible in the over-complicated naval profession.

KEDGING THE CONSTITUTION

By Lieutenant Commander H. D. McHenry, U. S. Navy

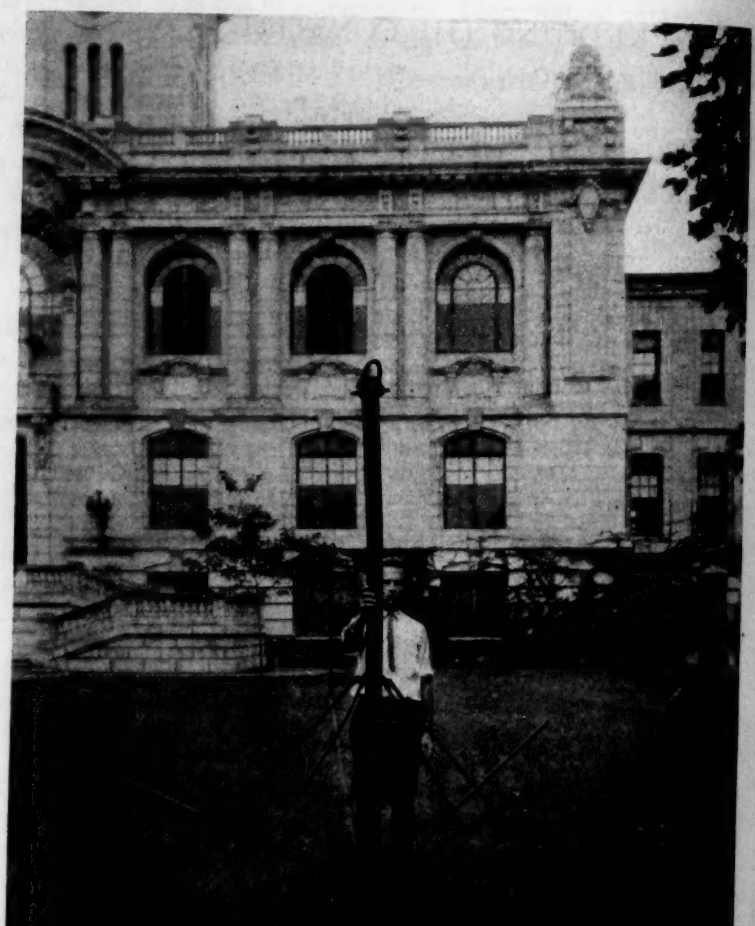
DO you remember the chase of the *Constitution* by Commodore Broke's squadron? You recall that at one stage of the chase, when the situation looked hopeless, Captain Hull resorted to kedging, and thus increased his lead. What was your conception of the kedge anchor used by Captain Hull? If you thought about it at all, you probably thought it was just an ordinary old fashioned anchor, small enough to be handled by pulling boats.

It might be well at this point to refresh your memory in regard to the events that led up to the escape of the *Constitution*. The following is from Appleton's *American Biography:*

"On her return from Europe, the *Constitution* went into the Chesapeake, was cleaned and newly coppered, and, shipping a new crew, proceeded to sea under orders to join the squadron of Commodore Rodgers at New York. . . . . On July 19, when five days out and under easy canvas, Hull came in sight of four sail, and soon after a fifth, which proved to be an English fleet under Commodore Broke, cruising off Sandy Hook. The enemy immediately gave chase. This is the beginning of the famous sixty-hour chase of the *Constitution,* which tried to the utmost the skill and endurance of her officers and crew."

It is not the purpose of this article to narrate the escape of the *Constitution,* but simply to call your attention to the method of kedging that was used and how this kedge anchor was constructed. While looking around the U. S. Naval Academy Museum I saw an umbrella shaped arrangement lying on the floor with a placard above reading as follows: "Kedge anchor (Drag or sea anchor), used by Captain Hull in warping his ship ahead to escape from the British." What centered my attention on the relic was that my conception of the kedge anchor was entirely different. This anchor looked like a large umbrella, folded, but without any covering over the ribs. The stock was made of wood and the ribs of iron. The stock was about 8′ 6″ long,

ribs about 6′ long, and the anchor had a spread, when open, of about 11′ 3″. There was an iron ring at each end of the stock for attaching ropes, etc.



KEDGE USED BY U. S. S. "CONSTITUTION"

We are indebted to Rear Admiral George F. Winslow, (M.C.), U. S. Navy, Retired, for the preservation of this famous relic. His letter is quoted as follows:

I am only able to give you that part of the history of the old kedge anchor of "Old Ironsides" that has come under my personal cognizance. In

1868, while on duty at the Boston Navy Yard, I had a carriage stored in a corner of the spar shed. In the process of removal of my carriage, my eyes, accidentally and fortunately, fell upon the anchor in an obscure corner of the building. After carefully examining the anchor, I made up my mind that this anchor was none other than the kedge anchor with which Captain Hull was enabled to haul his ship away from the English squadron. In regard to my discovery of this historical anchor, I will further add that I had the iron work cleaned to remove the rust, the wood work was scraped and then showed its natural color. Then I had it placed in the museum of the Boston Navy Yard, where it remained for years. Later in searching for papers and articles of historical value I found that it had been removed. After many inquiries on my part it was located at Annapolis. Shortly after the anchor was deposited in the aforesaid museum, the old spar shed, where it had lain for so many years, took fire and everything in it was consumed. I thought of the old anchor as I witnessed the conflagration and was glad that it was safe in another part of the yard.

The writer further states that while attached to the Boston Navy Yard in 1872, in company with Rear Admiral Coffman he went to see this anchor in what was then called the Naval Lyceum, where he had placed it.

How was this kedge anchor used? A canvas covering was placed over the ribs and the anchor sent out ahead. Its use can best be seen from the following quoted from the *Autobiography of Commodore Morris* by J. R. Soley:

With our minds excited to the utmost to devise means for escape, I happened to recall that, when obliged by the timidity of my old commander, Cox, to warp the *President* in and out of harbors where others depended on sails, our practice had enabled us to give her a speed of nearly three miles an hour. We had been on soundings the day before, and on trying we now found twenty-six fathoms. This depth was unfavorably great, but it gave me confidence to suggest to Captain Hull the expediency of attempting to warp the ship ahead. He acceded at once, and in a short time (about 7 A.M.) the launch and first cutter were sent ahead with a kedge, and all the hawsers and rigging, from five inches and upward, that could be found, making nearly a mile of length. When the kedge was thrown the men hauled on the connecting hawser, slowly and carefully at first, till the ship was in motion, and gradually increasing until a sufficient velocity was given to continue until the anchor could again be taken ahead, when the same process was repeated. In this way the ship was soon placed out of the range of our enemy's guns, and by continued exertions when the wind failed, and giving every possible advantage to the sails when we had air enough to fill them, we prevented them from again closing very near us.

It will be seen from the above that the anchor was not supposed to float, but probably scraped along the bottom, or close to it.

What action did the British take? In the *Frigate Constitution* by Hollis, appears the following:

> The *Belvidera* was the first to observe the mysterious drawing ahead of the *Constitution*, and Captain Byron was quick to imitate. He even devised a superior method of kedging by making an anchor fast to each end of a rope passed through two hawse holes. By this arrangement one anchor was carried ahead while the men were hauling on the other, and the ship could be kept moving all the time. Fortunately the lead was too great.

Is not this an excellent example of "Iron men and wooden ships"?

The use of kedges, warps, or floating anchors at that time must have been more or less general. Falconer's *Marine Dictionary*, 1815, says of the floating anchor:

> This is a simple instrument, which is sunk below the swell of the sea, where there is no other anchorage, for the purpose of preventing a vessel from drifting.

Dr. Franklin proposed that it should consist of a wooden cross from the ends of which a sail should be stretched, covering the cross, and even all the extremities. It has also been used in the figure of an *umbrella*.

Drags or floating anchors were used to decrease the speed of a ship as well as to haul it ahead. The following will illustrate: The U. S. S. *Philadelphia* was maintaining alone the blockade of the Harbor of Tripoli, and on October 30, 1803, while chasing a blockade runner, grounded on a shoal. In this situation she was attacked by a division of Tripolian gunboats and surrendered, being unable to offer any resistance. It was decided to burn the *Philadelphia* and the *Intrepid*, under Lieutenant Decatur, was selected for this duty. The *Siren* was to assist in this work. The following is quoted from the *Autobiography of Commodore Morris* by J. R. Soley:

> On the morning of the sixteenth we again obtained sight of Tripoli, with light winds, pleasant weather, and a smooth sea, and stood in for the town. By arrangements the *Siren* kept far without us during the day, and her appearance had been so changed as to lull all suspicion of her being a vessel of war. The lightness of the wind allowed us to keep up all appearance of an anxious desire to reach the harbor before night, without bringing us too near to require any other change than the use of drags, which could not be seen from the city. . . . . As the evening advanced our drags were taken in, so that we were within two miles of the eastern entrance at dark, the *Siren* being some three miles without us.

This expedition was successful in burning the *Philadelphia*.

IS HONG KONG LIMITED BY THE WASHINGTON TREATY?

By Captain Walter S. Anderson, U. S. Navy

THE most important provision of the Washington Treaty for the Limitation of Naval Armament was not in the original American proposal. It is of course Article XIX of that treaty to which reference is here made. It is article XIX that provided for the maintenance of the *status quo* of naval bases and fortifications in certain parts of the Far East. Such restricted parts include all American possessions west of Hawaii, but do not include Japan proper, French Cochin China, or British Singapore. In a word, it is America that makes the sacrifice, and a tremendous one it is. But that sacrifice is not the subject of this paper.

There is a curious paradox in connection with Article XIX. Two American naval officers of high rank have interpreted it to permit the British to develop a naval base and fortify without limit at Kowloon, which is part of Hong Kong. On the other hand, at least two British authorities on military and naval geography deny that any such right is possessed by the British. It is a happy circumstance that the alignment is of this nature. However, this point, while now of apparently but academic interest, may by the curious twist of affairs become a big one. It is hardly probable that Great Britain foresaw the use to which Germany would put Heligoland when in 1890 Britain ceded that strong little island to the Germans. And small points have a way of growing into important ones. It is one very inconspicuous clause in the Washington Treaty, or rather an objection based upon it, the merits of which objection are denied by America, that is now keeping America from giving her battleship turret guns the increased elevation required to give them parity with those of the other principal nations signatory to that treaty.

It is such considerations that seem to justify discussion of the question which forms the subject of this paper. As the interpretation of Article XIX is to be discussed, that article is quoted:

ARTICLE XIX [1]

The United States, the British Empire, and Japan agree that the *status quo* at the time of the signing of the present treaty, with regard to fortifications and naval bases, shall be maintained in their respective territories and possessions specified hereunder:

(1) The insular possessions which the United States now holds or may hereafter acquire in the Pacific Ocean, except (a) those adjacent to the coast of the United States, Alaska and the Panama Canal Zone, not including the Aleutian Islands, and (b) the Hawaiian Islands;

(2) Hongkong and the insular possessions which the British Empire now holds or may hereafter acquire in the Pacific Ocean, east of the meridian of 110° east longitude, except (a) those adjacent to the coast of Canada, (b) the Commonwealth of Australia and its territories, and (c) New Zealand;

(3) The following insular territories and possessions of Japan in the Pacific Ocean, to wit: The Kurile Islands, the Bonin Islands, Amami-Oshima, the Loochoo Islands, Formosa, and the Pescadores, and any insular territories or possessions in the Pacific Ocean which Japan may hereafter acquire.

The maintenance of the *status quo* under the foregoing provisions implies that no new fortifications or naval bases shall be established in the territories and possessions specified; that no measures shall be taken to increase the existing naval facilities for the repair and maintenance of naval forces, and that no increase shall be made in the coast defences of the territories and possessions above specified. This restriction, however, does not preclude such repair and replacement of worn out weapons and equipment as is customary in naval and military establishments in time of peace.

The writer feels some hesitation in recording himself in dissent with the two American officers whose conclusions he questions, as in common with others he recognizes their special attainments, and that they have made more than a casual study of such subjects. One of these officers, the late Rear Admiral H. S. Knapp, U.S.N., is unfortunately no longer living. He would, it is believed, have urged that a dissenting opinion held should be expressed, in order that final conclusions should follow full discussion.

Admiral Knapp, after quoting for consideration the first paragraph of Article XIX, then said: "When the specifications are read all the territories and possessions to which they refer are seen to be insular." [2]

[1] Treaty between the United States of America, the British Empire, France, Italy, and Japan limiting naval armament, signed at Washington, February 6, 1922.

[2] Limitation of Armament at the Conference of Washington, an address delivered by Rear Admiral H. S. Knapp, U. S. N. Retired, on April 27, 1922, before the American Society of International Law.

A difference of opinion as to their all being *insular* will be developed by this paper. Further on in the Admiral's discussion, he says:

The British have at Hong Kong a naval base now strongly fortified and well provided with supplies and equipment, including drydocks, either on the island or in the leased territory of Kowloon on the mainland just across a narrow channel. Hong Kong is ceded territory; Kowloon is leased only. Yet the two are really a whole for British purposes, and Kowloon does not fall under the inhibition of Article XIX, for it is not insular. In the convention of June 9, 1898, between Great Britain and China for the extension for ninety-nine years of what was therein designated as the "Hong Kong territory" although the extension was entirely on the Kowloon-mainland-side, the right to erect fortifications is recognized. As far as Article XIX under consideration goes, the right is not denied to the British to fortify and increase naval facilities on the Kowloon side at Hong Kong. It is evident that the British exercised no self denial in subscribing to Article XIX.[3]

Rear Admiral Niblack has written as follows:

Meanwhile, the British Navy has, equally to the regret of the United States Navy, failed to get provision for a naval base at Singapore, but there is nothing in the treaty which prevents the development and fortification of a naval base at Kowloon, opposite Hong Kong, as it is the leased territory and on the mainland of China, hence not insular.[3]

It is the second statement, the one about Kowloon, with which this paper is interested, but it may be observed in passing that the first statement, the one about Singapore, is not understood to be in accordance with the facts as now published.

We have now considered the case for an unlimited Hong Kong, strange to say, presented by American advocates. We will now turn to the opposition, supported by the British.

Major Salt, in discussing Article XIX, wrote as follows:

We have already seen that at Hong Kong, lying within the zone of non-fortification, we can build no docks capable of taking the battleships of the present, or, we may suppose, any future fleet, though her isolation and her position on the western flank of the Pacific remains unaltered.

By this agreement, Britain, having signed her hand, will abide. But as there is nothing in the agreement to prevent Japan fortifying, as she will, her own ports north of the boundaries of the peaceable zone, so there is nothing to limit the fortification of Singapore in 103° 51′ E., 300 miles inside the meridian of 110. . . . .[4]

[3] American Naval Policy, by Rear Admiral A. P. Niblack, U. S. N. Retired. This is Chapter VII of the Naval Section of *Brassey's Naval and Shipping Annual*, 1925. Wm. Clowes & Sons, Ltd., 94 Jermyn St., London.

[4] Page 338, *Military Geography of the British Commonwealth*, by Major A. E. W. Salt, B.A., M.A., Army Ed. Corps. Gale & Polden, Ltd., Aldershot, London and Portsmouth.

Mr. Vaughn Cornish has most clearly stated the case against an unlimited Hong Kong:

> Under the terms of the Washington Treaty for the Limitation of Naval Armaments, signed February 6, 1922, Hong Kong, hitherto the headquarters of the Royal Navy in eastern waters, cannot be provided with the large drydocks needed for the cleaning and repair of the latest capital ships, and the nearest harbor now available as a maintenance base of the fleet is in the island of Singapore, which is in round figures 370 nautical miles (430 statute or land miles) west of the meridian of 110° E., now known as "the Washington Line," and is 1,350 nautical miles more distant than Hong Kong from the Japanese ports.[5]
>
> Another concession offsetting the undertaking of the Japanese with reference to the Pescadores and the Loochoo Islands is that of the British Government not to undertake naval development in Hong Kong or British Borneo, which involves a withdrawal from 22° N. to 1° N., the latitude of Singapore. Here I must combat the contention of Rear Admiral A. P. Niblack, U. S. N., that "there is nothing in the (Washington) treaty which prevents the development and fortification of a naval base at Kowloon, opposite Hong Kong, as it is the leased territory and on the mainland of China, hence not insular." Article XIX, which contains the territorial provisions, has three clauses, relating to America, the British Empire, and Japan, respectively. The first refers to "the insular possessions which the United States now holds." The third to "the following insular territories and possessions of Japan," the second to "Hong Kong and the insular possessions which the British Empire now holds." In political geography the name Hong Kong means the Crown Colony so designated, of which Kowloon is a part, so that the fortification of Kowloon, as it appears to me, is both contrary to the intention of the Washington Treaty, and also forbidden by the wording of Article XIX.[6]

Both Admirals Knapp and Niblack apparently based their statements that Kowloon is unlimited by the Washington Treaty upon the assumption that Article XIX specifies that the *status quo*

Parenthetically, it is proper to state that Major Salt does say on page 336 that Article XIX "provides for a zone in which the *status quo* as far as naval bases are concerned, in the insular possessions in the Pacific . . . . shall be maintained." That is, at this one point he does make sweeping use of the modifying adjective *insular* in connection with possessions in the limited zone. However, after saying that the zone just mentioned does not include certain places, he continues, "but it does comprise Hong Kong. . . . ." His meaning, already clear that in his opinion Hong Kong is limited, is still further developed and clarified by the quotations given in the body of the paper.

[5] *Singapore and Naval Geography*, by Vaughan Cornish, D.Sc., F.R.G.S. Sifton, Praed & Co., Ltd., London, 1925.

shall be maintained only in "insular" possessions, which would leave continental possessions unlimited. But an inspection of Article XIX does not bear out the assumption that it is restricted to "insular" possessions. In the introductory clause, or preamble, it refers to "their respective territories and possessions specified hereunder." That is not modified by the adjective "insular." Then, as Mr. Cornish points out, there follow three numbered clauses referring to the possessions of the United States, Great Britain, and Japan, respectively. The first and third are modified by the adjective "insular." But the second begins: "Hong Kong and the insular possessions," etc. If Hong Kong had been therein considered as an island, this clause would have had to begin: Hong Kong and the *other* insular possessions, etc. The preamble referred explicitly to territories. Hong Kong is a territory. It is so referred to in the treaty which included Kowloon in that territory.[6] The pertinent part of that treaty is here quoted, in order that it may be seen that the treaty extended *Hong Kong territory* to include, among other areas, most of Kowloon:

> Whereas, it has for many years past been recognized that an extension of Hong Kong territory is necessary for the proper defense and protection of the colony,
>
> It has now been agreed between the governments of Great Britain and China that the limits of British territory shall be enlarged under lease to the extent indicated generally on the annexed map. . . . . The term of this lease shall be for ninety-nine years.
>
> It is at the same time agreed that within the city of Kowloon the Chinese officials now stationed there shall continue to exercise jurisdiction except so far as may be inconsistent with the military requirements for the defense of Hong Kong. . . . .[6]

It will be noted that the British reserved full rights in the Kowloon part of the extended Hong Kong territory, covering military requirements for the defense of Hong Kong. This left them free to sign away those rights, just as freely for the new area as the old.

The Statesman's Year Book for 1925 treats this subject with a definiteness that cannot be found in some encyclopedias. This publication, jointly edited by a former secretary and a fellow of the Royal Geographical Society, and compiled from official and

[6] Convention between Great Britain and China concerning the extension of the territory of Hong Kong, signed at Peking, June 9, 1898.

other publications, has a well known authority that requires no comment. Under the subject of *Hong Kong*, it has the following:

> The crown colony of Hong Kong was ceded by China to Great Britain in January, 1841; the session was confirmed by the Treaty of Nanking in August, 1842; and the charter bears date April 5, 1843. . . . .
>
> Hong Kong is situated at the mouth of the Canton River, about ninety miles south of Canton. The island is an irregular and broken ridge, stretching nearly east and west about eleven miles, its breadth from two to five miles, and its area rather more than thirty-two square miles; separated from the mainland by a narrow strait, the Lyeemoon Pass, about half a mile in width. The opposite peninsula of Kowloon, on the mainland, was ceded to Great Britain by treaty in 1861, and now forms part of Hong Kong. . . . . By a convention signed at Peking on June 9, 1898, there was leased to Great Britain for ninety-nine years a portion of Chinese territory mainly agricultural, together with waters of Mirs Bay and Deep Bay and the island of Lan-tao. Its area is 356 square miles, ... Area of Old Kowloon is three square miles. Total area of colony, 391 square miles. . . . .[7]

Therefore it appears that the name Hong Kong, in its official and most comprehensive sense, designates the crown colony. In a secondary and more restricted sense it designates an island forming a part, and a part only, of the crown colony of the same name. In that crown colony is also included Kowloon, both old and new, which is all the Hong Kong territory on the mainland. By giving the total area of the colony, which is the sum of the areas given for the various constituent parts, it is made doubly clear that Kowloon does form a part of the crown colony of Hong Kong.

It is therefore submitted that Article XIX limited to the *status quo* of naval bases and fortifications any territories enumerated in its clauses, that Hong Kong was enumerated, that Hong Kong is a territory, that it was differentiated from the insular possessions of Great Britain, making definite that it was not referred to in the sense of an island, and that the territory of Hong Kong includes Kowloon.

In a word, if the reader concurs with the foregoing résumé of this paper, he will answer our question in the affirmative. The conclusion may then be stated as follows: The Washington Treaty for the Limitation of Naval Armament does limit to the *status quo* of naval bases and fortifications of Hong Kong Colony, the territory of which colony includes Hong Kong Island, Kowloon on the mainland, and the Island of Lan-tao.

[7] *The Statesman's Year Book* for 1925. MacMillan and Co., Ltd., St. Martin's Street, London.

A FURTHER DISCUSSION OF NAVAL ORGANIZATION FROM THE INDUSTRIAL POINT OF VIEW

By Captain D. C. Nutting, (CC), U. S. Navy

Foreword

The numerous articles appearing recently relative to various phases of naval organization have seemed to the writer to justify the submission of the following notes originally prepared some fifteen years ago. From time to time since, generally in connection with some proposed amalgamation of all staff corps with the line, they have been revised, hence the numerous references to amalgamation.

In their present form they present some aspects of naval organization not hitherto noted by the writer in any of the discussions that have come to his notice. They also stress from a different point of view certain aspects covered by other discussions. These different aspects which are considered of especial weight are as follows:

(a) The differentiation of production engineering from operating engineering. (See especially paragraph 6.)

(b) The constructive value of criticism (and of friction as a means of arousing criticism) and the necessity for isolating production in order that criticism may lodge most effectively. (See paragraphs 7, 25, and 26.)

(c) Comments on industrial management as a super-specialty. (See paragraphs 9, 10, and 26.)

(d) The need for a large minority group with a production engineering ideal in order to attain the best results of criticism and of balance. (See paragraphs 12, 23, and 26.)

(e) The necessity that the Department organization be established by law, but that the legal provisions be restricted to the minimum possible consistent with proper functioning. (See paragraphs 30 and 35.)

(f) The necessity for placing absolute responsibility on the head of each major function and giving him assistants having no personal prerogative and no responsibility to any authority higher than their immediate superior. (See paragraphs 32 and 34.)

The scheme as set forth is not submitted with the idea that it is a cure for all the Navy's ills or that, even if such were the case, its adoption would be immediately possible; but as a statement of what the writer believes should be the fundamental elements of a practicable organization.

1. That the profession of the line officer is too extensive for complete mastery by a single individual seems to be demonstrated

by the development within the line of specialists along various lines; as for instance, strategy, tactics, radio, ordnance, gunnery, fire control, etc. The specialty of "Engineering" (by which word is meant in service parlance, "Propulsive Machinery") is also, by law, within the line but its fundamental character as a separate profession has compelled its being placed in a special status which gives to the body of officers specializing in it many of the characteristics of a corps, and these characteristics seem to the writer to be increasing rapidly.

2. In civil life the professions of naval architecture and civil engineering are considered too broad to be covered as a whole by single individuals and there are specialists in yacht design, cargo vessels, passenger vessels, small boats, etc., by naval architects; and in hydraulics, bridge construction, architecture, building construction, road building, railroad engineering, etc., by civil engineers. The fact that there is such specializing under conditions of commercial competition argues for the adequacy of even these subdivisions as fields for exclusive endeavor; in other words, for the equivalent of corps organization in the Navy.

3. There have been, in the line of the Navy, officers of such outstanding ability that they were capable of performing their line duties acceptably and of making an excellent showing of efficiency in one of the staff corps specialties. Similar statement might be made relative to the ability of certain staff officers to perform line duties in addition to their staff duties had opportunity for demonstration ever been permitted; but it seems to the writer to stand to reason that officers of such outstanding ability would, in the long run, accomplish more for the country by following lines to which they had given undivided attention than could possibly be the case if their experience were interrupted.

4. In an organization as large as the Navy, especially if it be a government organization where success must often be measured in terms less tangible than dollars and cents, special attention must necessarily be given to developing an organization adapted to the average attainments of the personnel. There will always be officers who by virtue of natural ability, personality, and dogged persistence in their natural bent, will acquire outstanding position and reputation as specialists under any condition of service but in practically all cases this will be the result of exclusive devotion to the specialty. The number of such officers

will at no time be sufficient to perform more than a small part of the routine technical work of the specialty, and the remainder must be performed by officers of only average attainments both as to technical ability and as to persistence in application. Average attainment in any specialty will be raised by an organization which prevents digression from the main path on the part of those who have not the persistence to fight for uninterrupted experience as specialists, and also by an organization which throws them into continuous close association and competition with others in the same restricted line of endeavor. This argues strongly for corps organization and applies as well to the line as to the staff.

5. *Esprit de corps* is high among naval officers and should be recognized as a strong force towards efficiency but there is lacking to naval officers, from the very necessity of the case, that condition which in commercial life makes income almost a direct measure of efficiency. In the Navy, income is fixed by rank and length of service alone; and so long as conduct is satisfactory and professional reputation as measured by service standards is high enough to insure selection, income increases with promotion as a matter of routine. It is therefore highly important that service standards be made as nearly as possible comparable with those which in outside life produce what might be called "bread and butter" efficiency. This also argues for corps organization since the service standard of reputation is thereby brought to a focus in each special activity with its own measures of efficiency instead of having to depend, as would be the case of the amalgamated specialists, on reports of fitness submitted by officers of whom few have specialized in the particular specialty and of whom many have no ability even to appraise in that specialty. Under amalgamation, fitness reports submitted under these unsatisfactory conditions must later be interpreted by a selection board working under the same limitations, and the net result must be adverse to the specialist unless he has been able to acquire a position of such outstanding preeminence that the board's action is virtually only an expression of service opinion; and such cases are rare.

6. Engineering, in the broad sense, has two branches, namely: production and operation. In the Navy, operating engineering must of necessity be confined almost exclusively to seagoing officers and all seagoing officers should therefore be operating en-

gineers, but the method of recruiting line officers falls far short of insuring that this is the case. There has, unfortunately, been an almost universal confusion in the Navy of operating engineering with engineering as a whole. While operation and maintenance of a mechanism or structure involve a considerable element of engineering as a whole, they are, after all, only a minor portion. The major part, in the strictly professional sense, is production. Operation will give the operator a very definite and exact knowledge of the suitability or unsuitability of any construction and of the results which ought to be obtained, but it does not, by any means, necessarily (although under the confusion above indicated it is very prevalently assumed to do so), qualify him for taking charge of production. The knowledge of suitability or unsuitability need not, and generally does not, result from a study of fundamentals of production. As a matter of fact the essential knowledge special to the operator, in so far as it affects design and production, may be communicated in great completeness during a short interview or in relatively short correspondence, whereas production, depending as it does on knowledge of materials, formula and processes, as well as on experience in shop methods and supervision of personnel not subject to military discipline, is a vast field in which, in most cases, the operator is without experience. From its magnitude no one may hope to have a comprehensive knowledge of it unless he devotes his whole time to it. This consideration, in the writer's opinion, argues strongly for specialists in production (in other words, for corps organization). The lack of appreciation of this essential difference between the two branches of engineering is not by any means restricted to the line but its prevalence in the service is almost wholly responsible for failure to realize the impossibility of attaining the highest efficiency under amalgamation. It has been demonstrated times without number that the production engineer may with little delay become an accomplished operating engineer, but the reverse is rarely the case and when true implies ability so much above the average as to constitute an exception to prove the rule.

7. An argument often advanced for amalgamation is that it would reduce friction. Line-staff friction has often been carried to such excess that it temporarily injured the service, but the writer strongly disagrees with the idea generally to be inferred from argument of the subject, that friction in itself is lastingly

harmful to the service. On the contrary he considers criticism (the source and often the essence of friction) the nearest possible substitute, in a service such as the Navy is, for the "bread and butter" efficiency of civil life. Efficiency growing out of criticism only is not of the ideal type but it is incumbent on the Navy to conserve every possible incentive to efficiency, and criticism is one of the most important. In itself and within reasonable limits it is extremely constructive. The fact that it is carried to excess does not disprove its constructive value; and the ideal organization for the Navy is one which recognizes it at its true value and provides a segregation of activities so that criticism by the user shall land absolutely and without the possibility of evasion upon the producer. This consideration also argues for corps organization since the line, being preeminently the user, is therefore the natural critic of engineering productions and only by corps organization can the producing engineering function be sufficiently isolated to prevent evasion of the line's criticism. If at times criticism is unjust and temporarily harmful to the service, such a condition would imply only the frailty of human nature and should be accepted as such. Unfair or partisan criticism could not, in the writer's opinion, begin to do the harm that would be done by abridgement of criticism or by making its evasion possible.

8. While the measure of efficiency by pecuniary standards is not generally practicable in the Navy there are certain production activities which so closely resemble commercial activities that comparison of costs is possible. Comparison of costs in these particular lines gives to members of Congress, in many cases, their conception of the efficiency of the Navy as a whole. It therefore behooves the Navy, both as a matter of expediency and as a matter of duty to the taxpayers, to adopt an organization that in these respects will permit costs comparing as favorably as possible with those obtained by commercial establishments. The organization for doing so would increase the certainty of taking advantage of economical developments growing out of industrial competition and would decrease the "apartness" of the Navy from the civilian population. Both these results are most desirable.

9. In civil life industrial plants are headed by managers who have arisen to their positions (except rarely in cases of special favoritism due to capital investment) through demonstrated efficiency along strictly production lines. They may have frequently

changed positions but it is rare (so rare as to be negligible) that they have not been continuously and intimately associated with production engineering for long periods. Such managers are pre-eminently the product of training superposed on inborn "faculty." Our navy yards are essentially industrial plants and they have not as a rule been efficiently managed for the reason that we have never had in the Navy a sufficient number of officers qualified both by natural bent and by training to fill all the managerial positions. A few line officers have shown outstanding ability in this direction but their efficiency would have been much higher had they come to the position through years of intimate connection with production engineering. A few naval constructors have likewise been notably efficient but a commission in the construction corps, even though coupled with years of industrial experience, does not, *ipso facto*, qualify a naval constructor as an industrial manager in the highest sense despite the general belief in the Navy at large that all naval constructors think so and in spite of the too prevalent opinion in the construction corps itself that it does.

10. Industrial management is a superspecialty, the talent for which is likely to develop rather late in life. Since it depends to a large degree on special bent, only a small percentage of production engineers in the wider sense ever attain the highest efficiency in it. Officers of the line assigned as managers, have generally been so detailed because they happened to have the rank assumed to be necessary for the particular position to be filled and happened to be available, or because they had acquired some reputation as operating engineers or in the very limited amount of production engineering possible afloat. Their efficiency has almost invariably suffered, even when they possessed native ability, through lack of experience; and by the time they had acquired a modicum of experience they were ordered to sea and the cycle, in so far as it affected industrial management, was repeated. Naval constructor managers have generally been chosen with better judgment but some limitations have been imposed by considerations of rank and still greater limitations by the fact that the corps has never been large enough so that the percentage of its members possessing natural bent for the superspecialty would supply an adequate number of superspecialists to fill the positions. At the same time, under the conditions existing, civil engineers even though they might be competent both by bent and

training, were not available. Thus on the whole the efficiency of line officer managers was reduced or destroyed by lack of experience even when (as was not by any means always the case) they had the bent, and the efficiency of the constructor managers was often not what it should have been because the corps was too small to produce the number of men who had superspecialized to fill the places. Experience can be given by training; natural ability and bent come by birth. Therefore, neither the line nor the construction corps, nor both as at present constituted and administered, can be depended upon to supply efficient managers in sufficient numbers. Under amalgamation the conditions unfavorable to high efficiency now inherent in the considerations governing detail of line officer managers would be extended to all managers and average efficiency would suffer. The above comments argue strongly for a large group of production engineering specialists from which by natural and voluntary superspecialization a sufficient number of those born with the bent will graduate from the school of industrial experience as competent managers. Those not attaining excellence as managers would still be amply employed in other production lines and failure to qualify as manager would not imply failure in efficiency. One of the ablest design engineers I have ever known was so lacking in the faculty for management that while he was senior assistant on an enormous enterprise not connected with the Navy, his senior could leave the job only in fear and trembling as to what condition he would find when he returned. Yet in his own field as a designing engineer this man was a wonder and never received one-tenth of the credit he had honestly earned.

11. The question of who shall perform duties ashore during war times has a weighty bearing on the subject. A line officer qualified to command, or qualified in duties leading to command, is necessarily imbued with the feeling that his maximum usefulness, to say nothing of his maximum opportunity for glory, lies in duties afloat in time of war and he has a right to feel aggrieved at being confined to industrial duties at such a time. On the other hand, the member of a corps trained to the thought that his value to the government lies in production engineering, will be satisfied to continue his regular duties in time of war. No one who had the chance to observe the disorganization of navy yards at the outbreak of the Spanish-American War or the World

War, due to the perfectly natural and laudable desire of line officers to get to the front, could fail to recognize the need of having a body of officers possessed of the ideal that their glory, in time of war as well as of peace, lies in the efficient performance of production engineering work.

12. There is another strong argument for a large and separate production engineering group, whether consisting of one corps or several corps, based on the consideration that there should always be a strong minority ideal in every organization to act as a balance wheel on the majority. Its value is proven by history throughout the ages. Lack of progress results from unopposed or only slightly opposed supremacy almost as quickly as from actual inefficiency. The line while possessed of the highest ideals is, after all, only human and the writer considers the maintenance of such a minority point of view (absolutely necessary also to insure segregation for criticism) especially a need in a military organization in a country where the military function is fundamentally conceived as being subordinate to the civil authority.

13. It is insistently argued by proponents of amalgamation that all the benefits of specialization may be safeguarded by provisions such as govern assignment to engineering duty only of certain officers in the present line. The writer has long held the opinion that such a status was illogical and dwarfing of efficiency in the specialty. Advantage has therefore been taken of every opportunity to learn the attitude of mind of these officers towards their status insofar as it affects their profession and their relations with other line officers. It is found that they may be divided roughly into four classes.

14. The first class is made up of officers who were more or less passively injected into the status by circumstances. These could hardly be expected to attain more than a modicum of efficiency even if they were held absolutely to their specialty and served uninterruptedly in a corps of similar specialists, but their present status in the line so fails in imposing the best conditions of development on them that they are much less efficient than they should be.

15. The second class consists of men often of excellent ability and with considerable faculty for their specialty, who, through failure to clearly distinguish the difference between production engineering and operating engineering, fail to visualize the mag-

nitude and importance of either and conscientiously believe in amalgamation. Such officers frequently become dissatisfied when they attain the higher ranks because they conscientiously feel they are qualified to command and should be allowed to do so if they desire.

16. The third class consists of officers with a vision of the magnitude of their specialty who have accepted their present status as being the one permitting the nearest approximation to ideal conditions now possible but who are constantly chafing under the present limitations on purely professional development and resent their inability to achieve the highest results, without possessing personality enough or persistence enough to achieve their ideals despite the limitations. The state of mind of such officers may be gathered from a statement by one of them to the writer to the general effect that he was inclined to be sorry he had applied for engineering duty on account of lack of freedom to follow it and moreover was not at all sure he liked the company he was in on account of the large number of those similarly assigned who fell under the heading outlined in paragraphs above.

17. The fourth class consists of those with a vision of the magnitude of their specialty and possessed of enough personality and persistence to be able to actually follow it fully. Their number is small but they are almost invariably pointed to as a proof of the success of amalgamation. They should be considered only as the exceptions proving the rule to the contrary.

18. The above are the outstanding arguments for corps organization as the writer sees them. Carried to their extreme limits of application they would call for a corps of strategists, a corps of tacticians, a corps of command officers, a corps of fire control officers, a corps of radio experts, a corps of powder experts, a corps of electrical engineers, a corps of accountants, a corps of disbursing officers, a corps of storekeepers, a corps of industrial managers, a corps of naval architects, a corps of civil engineers, and for many other corps. And to make these corps theoretically most effective each corps would culminate in a bureau. Such an organization while ideal from the strictly specialist viewpoint would be so difficult of coordination as to be utterly impracticable. Discussion of these difficulties is reserved for a later paragraph and will not be pursued further here. There are, however, certain functions of such magnitude and so essentially critical of

each other that regardless of all rules and regulations they will virtually segregate themselves into independent organizations. Therefore the fundamental question of concentration (amalgamation) resolves itself into the question of how far amalgamation may proceed and along what lines without killing the efficient performance of the various functions.

19. In the writer's opinion the most practicable method of approaching, as nearly as the numerous conflicting elements will permit, to the ideal organization is by doing away with the present Supply Corps, Construction Corps, and Corps of Civil Engineers and by establishing a corps made up of all the officers now specializing in production engineering in its various forms. These would include in addition to the present supply officers, naval constructors, and civil engineers, those officers who have specialized in the production phases of the duties now under the cognizance of the Bureaus of Ordnance, Engineering, and Aeronautics. There would be some room for argument as to the desirability of including the officers of the present Supply Corps but after carefull consideration the writer is of the opinion they should be included for reasons set forth in a succeeding paragraph.

20. Some officers of the experience outlined above might not be willing to be transferred to such a corps and should be given the privilege of remaining in or transferring to the line but only on condition that they qualify for line duties.

21. The proposed corps might be logically referred to as either the Engineer Corps or the Industrial Corps. The personal preference of the writer is for the title of Engineer Corps and that title will be used during the rest of this discussion.

22. The duties now performed by officers of the Supply Corps cover four well defined specialties in civil life, viz.: storekeeping, purchasing, disbursing, and commissary management. The three first named are common to duty ashore and at sea. Duty as commissary manager would be almost exclusively performed at sea. It might, therefore, be argued with considerable show of logic that the principal duties of the present supply officers are in connection with operating functions and that they should either be retained as a separate corps or amalgamated with the line. Retention as a separate corps is undesirable on account of difficulty of coordination. Amalgamation with the line would be unwise on account of the responsibility of these officers to the Treasury

Department additional to their responsibility to the Navy Department. This additional responsibility grows primarily out of their accounting and disbursing functions and has resulted in the promulgation of a mass of laws, regulations, Treasury Department decisions and legal decisions so great that in themselves they constitute the most vital governing condition of service and more than any of the strictly naval duties of these officers set them apart unescapably as specialists. No officer could afford to take the financial risk attaching to the disbursement of naval funds and materials without continuous service in those lines for he would be absolutely within the power of his subordinates. This primary argument for segregation as specialists has no bearing on the question of whether or not the present Supply Corps officers should be included among those of the proposed Engineer Corps but it seems to the writer that those activities common to duty ashore and afloat have a more vital relation to the efficiency of production engineering than to that of operating engineering and for that reason and in order to avoid a separate corps it is deemed that the greatest efficiency of the service would result from inclusion of the present supply officers in the proposed Engineer Corps. The question as between inclusion in the Engineer Corps and retention as a separate corps is admittedly open to argument but the special character of the duties is so fundamental that to his thinking the only alternative to including them in the Engineer Corps is to retain them as a separate corps, which as stated above is most undesirable on account of difficulty of coordination.

23. The protagonists of amalgamation of staff with line stoutly maintain that the separateness and opportunity for development of the various productive engineering specialties could be as absolutely assured under amalgamation as by separate corps existence and would naturally apply that argument against the proposed Engineer Corps. The two conditions necessary in the Navy to insure the highest efficiency of the various individual specialties are: first, some common concept or ideal sufficiently strong and universal within the group to which the specialist belongs to give appreciation on the part of all the members of the group of the need for freedom of each specialty to develop and to function freely; and, second, a group large enough to constitute a strong minority in professional ideals as compared with the line. This common concept in the proposed Engineer Corps

would be supplied by the common ideal of production engineering and its possession by all members would be automatically insured by the fact that assignments to the corps would be made only on application growing out of natural inclination and after special training to permit accurate judgment of suitability before admission. The line is necessarily made up of all the graduates of the Naval Academy for whom vacancies exist and there is no condition for entrance except satisfactory completion of the Naval Academy course. The graduates will, of course, include many, possibly a majority, who have no production engineering bent and many who will not seek to specialize at all even in specialties logically falling within the line; hence the universal possession of the engineering concept by line officers is impossible and unless the universally common concept exists the specialty will suffer. There have been numerous orders and regulations specifically setting forth the Department's wishes that specialists be given opportunity for development and providing machinery intended to make them effective, but these cannot provide the productive engineering *atmosphere* and the ideal will not thrive other than in the proper atmosphere, which, to the writer's thinking, can be supplied only by restriction of the production engineering specialists by law to a group universally possessing that concept and with a status as a group coordinate with that of the operating engineering group, the line. That the proposed Engineer Corps must be a creature of law will be apparent to any one who has kept track in a critical way of the cycles through which every policy of the Navy Department not specifically defined by law has traveled even when, as has been far from always the case, the stated policy was not practically ignored by the service.

24. The establishment of an Engineer Corps as outlined above would be worth while under any conditions but its value would be only a fraction of what it should be unless the organization of the Navy Department were radically changed and consideration of this phase of the matter is therefore necessary.

25. A material advance in ideals of Navy Department organization and administration was made when Secretary Meyer approved the establishment of the Divisions of Operation, Personnel and Material in 1909. There was complete failure on the part of those responsible for preparing the details of the scheme to appreciate the separateness of, and the essentially critical relations

of production and operation to each other (the criticism growing out of which is the highest possible form of "inspection") so the Meyer scheme called for a Division of Inspection coordinate with the other three. The function of inspection is extremely important and should be amply provided for in any organization but its existence as a coordinate division of the Navy Department was illogical and the natural logic of the case caused its discontinuation as soon as its existence ceased to be necessary to preserve the "face" of the protagonists of the organization as a whole; in other words, as soon as logic and not partisanship came into play. The bitter controversy incident to the establishment of the organization did much temporary harm to the service but is the most outstanding demonstration the writer knows of of the assertion made above that criticism ultimately results in good and should never be abridged. The full discussion which the system received could not have occurred had there not been corps organization—in fact the divisional organization was the direct, though unacknowledged, outgrowth of the efforts of the Construction Corps to establish functional organization at navy yards and was the line conception of what the corresponding Department functional organization should be. It fell far short of what it should have been for two reasons: the minor one of a coordinate inspection division (involving unnecessary correspondence) and the major one of failure to abolish the bureaus. So long as the bureaus existed they were answerable to the law for expenditures and the chiefs of divisions had no real authority, hence the Meyer organization in reality added four offices to the already too many through which correspondence had to pass, and corresponding delay and red tape resulted.

26. Failure to abolish the bureaus was doubtless due to opposition of the naval constructors and of the Bureaus of Construction and Repair and Supplies and Accounts and this opposition was expressed, as was the sentiment on the other side, in far too partisan a spirit. However, even had the bureaus been abolished at that time the organization would still have fallen short of ideal efficiency due to its failure to even conceive, to say nothing of recognize, the existence of operating engineering as an entirely separate branch from production engineering and a branch essentially critical of it. This failure was natural when it is remembered that almost without exception all of the aides under

Secretary Meyer represented the extreme military conception of naval activity, a point of view essentially incapable of possessing the production engineering concept.

27. It may be stated positively that the ideal organization must provide for isolating the function of providing material (of which the largest and most important element is production) from the other two logical functions recognized by the Meyer scheme and for so fixing its relation to them that their criticism shall land absolutely and without possibility of evasion. It is equally essential that the head of the material division (in whom all the production engineering functions head up) shall have the highest technical and managerial ability and experience. This absolutely demands that he be a member of the Engineer Corps. The principle of strong minority representation, the necessity of which I have tried above to make clear, is also fulfilled by this condition. The line as the ultimate means of making the fleet effective as an operated agency should dictate policies and should enunciate the ideals which the material should meet but, having done that, it should leave the technical details of providing the material to be worked out as a strictly production engineering problem under production engineering specialists but still subject to operating engineering criticism (inspection) of results.

28. The three proposed heads of divisions in the Department together with the Assistant Secretary would logically form a cabinet to the Secretary of which a majority in technical naval matters would properly be line officers and in which the civilian nonpolitical point of view would be represented by the Assistant Secretary. It would be rare that any secretary would not instinctively defer to line opinion as representing the heart of the Navy and this would reinforce the line's numerical majority in his cabinet as it should do, but it would be a sorry day for the Navy in the writer's opinion, should there be failure to have the production engineering specialists represented in this cabinet by a production engineering specialist, preferably the most able of all these specialists and of the most judicial temperament.

29. In the reorganized Navy Department as proposed above it will be noted that the Assistant Secretary is retained but his status should be changed so that he would be a permanent nonpolitical appointee in order that he might carry over from Secretary to Secretary in a more authoritative way than is now possible

through the Chief Clerk (who is now the senior permanent non-political civilian official) the policies and the ideals of the Department from the non-political civilian point of view. While the details of his responsibilities would naturally and logically vary with different secretaries he would necessarily represent to a large degree the civilian ideals of the government, especially the right of the civilian authority to exercise supervision over efficiency of expenditures and over civilian personnel. This would mean that fundamentally the Secretary would represent the political will of the people as exemplified in the party in power; the Assistant Secretary would represent the will of the people in business matters and would be liason officer between the civilian political dominating power and the technical naval organization maintained by that power for sea protection; the aides would represent the technical naval organization, having nothing to do with politics and actuated by the ideal that technical results in the extreme event of war would be more important to the nation than absolute economy at any time but with the element of production engineering effectively represented both as a means of obtaining the most efficient tool for the nation's naval protection and as a means of obtaining it at the smallest practicable cost to the nation.

30. The idea that the bureau is the theoretically logical focus of each specialty has been set forth above, but the number of bureaus now existing is not logical from a practical standpoint, due both to the illogical distribution of cognizance causing much paralleling of effort by different bureaus and to difficulties of coordination growing simply out of the number of bureaus. A minor cause of this difficulty is also the very human tendency for each bureau chief to exalt his bureau's specialty to a position not justified by the general good. As now existing each bureau is charged by law (as embodied principally in the appropriation acts) with responsibility for expenditures of certain definite appropriations to accomplish work largely detailed in the acts; and although the Secretary has power to distribute duties among the bureaus this does not prevent the condition that in the matter of expenditures the bureau is fundamentally answerable to the law and not to the Secretary. It is out of this condition that almost all of the power of the bureaus, and a large percentage of the red tape in the Department, grow. The law, by imposing penalties

for dereliction, implies the liability, at least, of criminal acts on the part of every government official. Partisan politics has fostered the assumption on the part of a large percentage of the citizens of the country that every government official (or at least all those with whom the particular citizen is not personally acquainted) is a grafter. The net result is to place the government official in the position of being popularly and often legally, though informally, adjudged guilty of grafting unless he can prove the contrary. Out of this condition and the resulting necessity for each official in primary responsibility for expenditure of an appropriation to have written records to prove his innocence of malfeasance, grows nearly all the complication and delay known as "red tape." Observation indicates that the amount of red tape increases more nearly in geometrical than in arithmetical progression as the number of coordinate establishments increases. Hence the more bureaus, the much more red tape. Avoidance of red tape therefore means reduction in the number of coordinate agencies with responsibility directly to the law. This does not however mean that all the functions of the Navy may be handled efficiently without legal authority for certain bureaus or divisions subordinate to the Secretary, and even if this were possible it is inconceivable that Congress would be willing to keep its hands off the department organization to that extent. The adoption of the organization based on the three logically coordinate divisions of operations, personnel, and material would effect an enormous reduction in correspondence and red tape and would be, the writer believes, a minimum on account of the essentially fundamental character of the functions and their mutually critical relations. By making the appropriations in lump sums under these three heads, a maximum of operating efficiency would be obtained with the minimum of accounting complications and even more absolute control of expenditure than is now the case could be reserved to Congress by placing a limit on details of expenditures from those lump sums instead of, as now, making detailed appropriations.

31. The exact distribution of present bureau and independent activities among the three proposed divisions would in some cases have to be more or less arbitrary but if the clear distinction between production and operation is kept in mind an entirely practicable distribution can be made. Personnel and material are in the largest sense the producers for the use of operations but opera-

tions and personnel would in some matters be the producers for material; and operations and material the producers for personnel; and each would be the inspector of the others' work. Each would therefore maintain a more or less well developed inspection organization as a component part of its makeup.

32. It would be exceedingly important that material production and maintenance should be absolutely under the cognizance of the Material Division by law but this does not mean that in minor cases the Material Division should not delegate the performance of minor production and maintenance functions to the head (not to any subordinate) of a particular operative establishment. This would always be the condition in so far as maintenance of equipment afloat by the ship's force is concerned but in all such cases the material function should rest in the immediately responsible senior. When members of the Engineer Corps were ordered to duty in connection with essentially operation or personnel activities (as should be freely done and vice versa) it should be in subordinate or consultative capacities and the detail should be considered as the loan of special experience to the other activity and not the extension of the activity constituting the main responsibility of the division to which the personnel belongs.

33. The Medical Corps and Chaplain Corps might be maintained as separate bureaus without very great difficulties of coordination so long as construction and maintenance of hospital buildings was always recognized as a material function, but they should be essentially subordinate to the Personnel Division. The Judge Advocate General would logically pertain to this division also as would the Selection Board and Examining and Retiring Boards and the hospitals and Naval Home. The solicitor would represent more a civilian than a military function and might be answerable directly to the Secretary or Assistant Secretary as coordination would not be difficult on account of his limited contact with the three main functions. The General Board and Board of Inspection would logically belong to operations. The functions of the various staff departments of the Marine Corps would be merged into the appropriate main division if the corps were not retained in its separate status as at present (for which there is considerable argument) and all functions now exercised by the various bureaus not an essential element of production would be transferred to the appropriate operating or personnel division.

34. Certain specialties such as Marine Corps (if not retained in its present status), Medicine, Chaplain's work, Judge Advocate General's work, Design of Ships, Propulsive Machinery, Aircraft, Ordnance, Civil Engineering, Purchase and Issue of Materials, etc., are of such outstanding and fundamental importance that they are entitled to special recognition and dignity in carrying out the scheme and this recognition could be accorded by preserving to them the present titles and rank of the chiefs of the bureaus to which they now pertain but they should be definitely and permanently deprived of their present direct responsibility to the law for expenditure of appropriations and should be simply assistants to the head of their division and with no power or authority other than that delegated to them by him as his assistants. Then if the ordnance function had special interest in a hull construction problem the Chief of Ordnance and the Chief Constructor would confer verbally and work out the plan jointly either in person or through their assistants; their conclusion would (without correspondence between them) be embodied in the appropriate letter and would be signed by or in the name of the Chief of Material to whom would attach all the responsibility to the law for the expenditure involved and who would have to suffer for their dereliction just as now the Captain of the ship must suffer for the dereliction of his watch officers unless there is actual fault on their part of a kind which is personal rather than administrative.

35. The consolidated industrial management now in effect at some navy yards would be, under this scheme, the standard navy yard organization and would be answerable to the Division of Material (details handled by an assistant to the Chief of Division occupying exactly the same relation to him and having the same rank as that of the other chiefs) in much the same way as is now in effect. Numerous officers not belonging to the Engineer Corps would be attached to the yards and would be given appropriate duties by the manager under general direction of the Commandant and not by the orders of the Department. To assign officers to any subordinate position in a yard by specific orders of the Department results in somewhat the same anomalous relation between the Commandant and the Department as now exists between the bureaus and the Department in that such officers would be answerable more or less to the Department instead of to the Com-

mandant, just as the bureaus are now answerable to the law instead of to the Department. The principle of concentrating all responsibility and authority absolutely in the immediate head of each activity and of so wording every communication as to recognize his subordinates only as his assistants with no independent authority or responsibility is exceedingly important—so much so as to be fundamental to the reduction of red tape to the minimum.

36. The idea of organization as set forth above has been discussed freely with many officers. Two objections to it have frequently been made. One was that presumably the officers of the Engineer Corps would object to going to sea and would therefore fail to get the viewpoint of the operating branch of the service. The other was that, by virtue of control of appropriations, the head of the Material Division would exercise undue power in the Navy.

37. The objection last mentioned would seem to be answered by the fact that under the scheme of appropriations above advocated operations and personnel would each have control of appropriations equal to, possibly larger than, that pertaining to material and in addition two of the three Chiefs of Division in the Navy Department would represent the combatant branch of the service. If in spite of these two facts the Chief of Material were able to dominate the situation unduly, the situation would call less for his suppression or the suppression of any of the functions of his division than for a change in the chiefs of the other divisions. The argument seems to the writer to be without force.

38. The objection based on assumed lack of sea service for officers of the Engineer Corps is much more valid. It has been unfortunate both for the Navy and the Construction Corps that naval constructors have not in the past had more sea service. That they have not done so has been due more to lack of numbers to adequately cover the duties which must be covered on shore than to a lack of appreciation of the benefits to be derived from sea service and, in the writer's opinion, every officer of the proposed Engineer Corps should have regular sea duty. That does not admit however that it should be distributed as most of the advocates of it propose or as has been proposed in most of the printed discussions of the subject. In the line, whose specialty is operation of ships in accordance with the best available principles of navigation, tactics and strategy so that they may most efficiently

serve the interests of the country, it is a well recognized principle that as officers advance in the service and gain a wider administrative experience the ratio of their sea service to their shore service decreases. The same principle should govern as relates to officers of the Engineer Corps but the argument for a greater percentage of shore duty at all times, and especially with advance in rank, is much stronger. The officer of the Engineer Corps who had arrived at the rank of commander or captain should never go to sea for a period long enough to seriously affect the continuity of his strictly productive engineering experience nor (of course) should he go except on the staff of the commander-in-chief or the commander of a large section (division or squadron) of the fleet (a possible additional exception might be as Engineer Officer of capital ships). His sea service should be partly in a consultative capacity and partly to permit him to absorb at first hand the personal relations and vital characteristics of the seagoing point of view. A maximum of six months at a time repeated about once in four years ought to be ample for a captain or commander. Junior officers should go oftener and stay longer for the reason that in addition to acquiring the benefits outlined above they should have direct and personal responsibility under the captain for maintenance work which is strictly in the line of their specialty. They should never go to sea for more than a year at a time however.

39. This discussion would not be complete without some consideration of the method to be adopted for recruiting officers for the proposed Engineer Corps. It was unfortunate that all of the older officers of the Construction Corps were assigned permanently to the corps almost immediately after graduation and in a few cases before they really knew their own minds or had had a chance to strongly develop even in embryo the production engineering bent. There was sometimes a lack of feeling of responsibility on the part of commanding officers in making recommendations for assignments to the corps, an extreme illustration of which found utterance to the writer by one commanding officer relative to one cadet whom he had recommended "because I thought he might make a good naval constructor. The Lord knows he was absolutely useless aboard ship." The seniors in his prospective corps were then entirely without opportunity to judge his probable efficiency from actual observation.

40. Every consideration of conservation of productive engineering as a profession and of its best relation to the service as its efficient servant dictates that the following questions shall be definitely and affirmatively answered by or for each candidate for assignment to the proposed Engineer Corps before he is commissioned therein:

a) Has he the mental characteristics which will make him more useful to the service as an officer of the Engineer Corps than as an officer of the line?

b) Is he convinced in his own mind that as a life activity he would prefer duty in the Engineer Corps rather than duty in the line?

c) Has he the strictly professional fundamental education necessary as a ground work for his duty in the Engineer Corps?

41. The opportunity for obtaining the correct answer to all three of these questions would it is believed, best be afforded by the routine outlined below:

a) At the end of the second class year at the Naval Academy give each midshipman the privilege of applying for a commission in the Engineer Corps for a particular specialty and continue the privilege to ensigns until they have had eighteen months service as such.

b) Until the applicant has reached the end of his second year of service as an ensign permit him at any time to change his application to a different specialty from that originally named.

c) Permit the applicant to cancel his application at any time prior to actual commissioning in the Engineer Corps, the cancellation resulting in his continuing in the line for strictly line duties subject to examination.

d) Send all applicants to sea on actively cruising ships for their three years' service as ensign.

e) Assign applicants to strictly line duties for the first year of their service afloat and after that give them progressively more continuous and more responsible duty in their chosen specialty in so far as it is possible to do so aboard ship, taking care that this duty shall include a fair proportion of routine drudgery along the line of the specialty.

f) At the completion of three years at sea as an ensign send the applicant to a civilian technical school for three years to pursue

a course in his chosen specialty taking care that he is placed in classes with men who are studying for the practice of the specialty in civil life. (This is for the purpose of giving him some insight into the considerations which lead to "bread and butter" efficiency in civil life.)

g) Send him to some shore station for routine drudgery work in his specialty during his first vacation from his educational course and to sea for the same type of duty during his second vacation.

h) For two years after graduation from the educational course send him to a shore station for routine work in his chosen specialty (to as great an extent as possible, these activities to be in the nature of drudgery).

i) Then send him to sea for one year with the privilege of serving either on deck or in his specialty.

j) If he then still chooses to follow his specialty, commission him in the Engineer Corps provided he is recommended for it by all his commanding officers both line and staff. Otherwise, unless the Chief of the Division of Material recommends to the contrary, do not assign him to the corps.

k) Promote him regularly under a line commission until his commission in the Engineer Corps is given him.

l) After being commissioned in the Engineer Corps, give him the privilege for three years to return to the line provided he passes the regular line examination for the rank he then holds.

m) Give to all line officers of not less than nine and not more than twelve years commissioned service the privilege of transferring to the Engineer Corps as extra numbers and without loss of rank or precedence provided their transfer is recommended by the Chief of Material and provided they pass a satisfactory examination before a board composed of officers of the Engineer Corps.

42. The net results of this procedure would be as follows:

a) It would be unfair to the line in that it would throw back into the line those who failed either through vacillation or lack of bent to get commissions in the Engineer Corps. This unfairness would however be offset to some extent by the special training received by those officers who made application and took the course but then declined to accept commissions in the Engineer Corps.

b) It would compensate the service at large for the expense

of the special training of those not commissioned in the Engineer Corps through their wider usefulness as operating engineers.

c) It would insure that no unsuitable candidate would be commissioned by requiring favorable reports on his suitability by all seniors in both the line and the Engineer Corps.

d) It would insure that the candidate had had sufficient service in both branches to give him assurance in his own mind that he really desired assignment to the Engineer Corps but would give opportunity still for three years to change his mind.

e) It would give a limited opportunity to get into the Engineer Corps to the men whose special engineering bent developed late, as is sometimes the case.

f) It would insure that all officers of the Engineer Corps were possessed of sufficient sea service to appreciate the seagoing point of view. This would be continued by progressively shorter and less frequent tours of sea duty in later life.

43. Each officer in the Engineer Corps would train for and continuously function primarily in the specialty for which he was trained and the common ideal of production engineering throughout the membership of the corps could safely be trusted to insure that he were left free to attain the highest development of which he was capable in this specialty. The specialists of all kinds would be carried on one list, their places being fixed by general rules of promotion, rank and precedence and their numbers being determined for each specialty according to the estimated requirements at time of entry. The character of each officer's specialty would be indicated by some reference mark opposite his name on the list. Each officer regardless of his specialty would be considered as in training for voluntary superspecialization in industrial management and as being eligible under general rules as to rank and service (not specialty) to the positions of Manager at navy yards and Chief of Material at the Department.

44. Details of procedure to care for maintaining the precedence, etc. of candidates have not been discussed as this is a matter of detail rather than of principle and could readily be worked out. Nor has the question of how many officers should be assigned to the Engineer Corps nor the possible development of operating specialists in the line been discussed. These questions are interesting but are not sufficiently vital to the present discussion to justify increasing its length.

WANTED : ORGANIZED PUBLICITY

By Brockholst Livingston

IT SHOULD not be necessary to employ publicity in order that the American people might become informed of the need of a navy. Sea power has meant too much to this nation for the people of the land to forget its strength and usefulness. The pages of history teem with the stirring accounts of our naval heroes and yet what does the average person of America know of the Navy? In the rush and bustle of modern life, the average man—and now, the average woman—is so taken up with business and his own affairs that he believes it a profitless exertion to meddle in the nation's business. Government, to him, is a question of "let George do it." He fails to understand that he is as much a stockholder in the organization of the state as he is in his joint-stock company or partnership. The success of this, the greatest of corporations with its acts of incorporation embodied in the Constitution, reflects upon its stockholders. Its ascendancy makes possible the triumph of the minor business organizations of the nation. Without good government no nation and consequently no business will succeed. A participation in the affairs of the land is not alone of profit to the individual. It is a duty laid upon him by citizenship.

It is not the intention of this paper to deal with the duties of citizenship in the broad way in which it should be dealt. For our purpose the naval side of government will suffice. If the great task of indoctrinating the American people in matters connected with the Navy is achieved, those who have accomplished this splendid work may then rest, filled with a sense of pride. America may well applaud, "well done my good and faithful servants."

Congress, as the body representative of the people, is empowered "to provide and maintain a navy." To provide and maintain a navy is so naturally a privilege and duty accorded a sovereign state that the Federal Convention made provision for such an organization. Although the acquisition of a navy was made possible, nevertheless, funds were not made available until several years later. Actual need made a navy imperative and Congress

provided for it. The history of the American Navy has been one of ups and downs. As a general rule, the American people have failed to realize the need of sea power until actual warfare—or piracy—brought home that need. It has been a case of rapid expansion in war and almost as rapid deterioration in peace. In the years before the World War the American public could not be persuaded that a navy must be built *and maintained*. The publicity which was used was ineffective. Now, in these days following upon the World War, the naval publicist is confronted with additional problems. It is not only necessary at this time to make the people realize the need for a navy; it is necessary also to use enough fact and persuasion to overcome the propaganda employed by pacifists, aircraft supporters, and world peace-at-any-price advocates. These false doctrines must be conquered and it is to the publicist we look to undertake their defeat.

Publicity is recognized as a means of indoctrinating the people. It is carried on by small businesses in order that they may become larger. The big business uses it that the small will not take its place. Why should not the Navy as among the largest organizations, employ it? The enemies of the Navy use a well-planned, efficient, and appealing propaganda. The newspapers print their pleas and plans. Why should they refuse to publish naval news?

The author trusts he will not be boring if he quotes rather extensively from the work of others. It is only in the interest of better publicity.

Lieutenant Krause in his prize-deserving essay stated: "What does the average man know about the Navy? During the last few years . . . . . he has read, mainly, accounts of uninformed writers. . . . . What are we doing to counteract the insidious propoganda which is being disseminated from various sources? . . . . Nothing but study the problems, form our opinions, and then keep them to ourselves?"

Admiral Mahan at an address before the War College, September, 1892, made a few remarks concerning the word "obsolete," which will bear repeating here in connection with false doctrines:

> I propose today to devote my remarks only to those objections which, while superficially plausible, are, I am convinced, due to lack of reflection and to the tendency we all have to be influenced by words or phrases, without pausing to reflect that, in their true and commonly received meaning, they are not really applicable to the thing to which, for the moment, they are applied. Take, for instance, the word "obsolete." I doubt if there is any one word in the language that did so much harm to the United States

Navy as this little one in its misapplied, yet common, use, during a period of years with which I and many of my hearers have been contemporary. The ship built today, it has been freely said, will be "obsolete" ten years hence; nay, we were fortunate if we escaped the stronger yet equally positive assertion that the ship laid down today will be "obsolete" by the time she can be launched. What was the result of this seemingly slight and harmless exaggeration of talk? Why, simply this: That with all the valuable services and prestige of the Navy during the War of Secession, with the popular favor still green, with Farragut scarcely yet in his grave, everything like naval advance was stopped because of the threat of obsolescence. "Of what use?" asked the unprofessional citizen, safe in an immense professional backing in the use of this word and its ideas, "of what use to build ships which are so soon to be obsolete? Let us wait until we have reached something that will not become obsolete." So we waited, with our hands and energies ironed by the little word "obsolete," until, less than ten years ago, the material of the American Navy was the derision of the world and the mortification of our officers; and even now, despite the judicious and untiring efforts of recent secretaries, we have not, and for some years to come will not have, a navy commensurate with our national importance, or fitted to fulfill our fast growing sense of our proper sphere or influence in the world outside our borders. Within two years I have seen the American Navy styled a phantom fleet by an English newspaper of the first rank.

How ready, all this time, the country really was to respond to an intelligent presentation of the necessities of a navy, has been shown by the liberal appropriations, and yet more by the liberal expressions of men of all parties and shades of opinion. . . . . What stopped advance was not the unwillingness of the country, but the cry of "obsolete." . . . .

The American people are naturally of a "follow-the-leader" turn of mind. Often without reasoning out a thing for themselves, they blindly copy what someone else had done. The organization with the best publicity conquers the sympathy of the nation. Many times it is a case of "first come, first served." The cry of "obsolete," of "aviation" and the myriad other fads and fancies which have appealed to the people, have been successfully brought about by nothing more nor less than publicity. Why can we not install the right ideas by the use of the same medium?

If we will delve into the matter of pacifism and aircraft propaganda we will find that, as a rule, it is directed towards the Navy. For some reason, the sea forces are chosen as the butts in this dangerous game of robbing us of our security. There is a rabid desire to rid the nation of naval power. The person who supports a plea for a reasonable navy is frowned down upon as some kind of freak. The papers can fill their columns with "Plans Big Strike

Against All War," "Senator Declares for Outlawing War," but let a navy writer ask for an additional ship or man and the wrath of all the pacifist gods is called down upon his head. A news item in the New York *Times* in January was entitled: "World Court Drive Begun in Forty States." The next item informed us of an arrangement by the New York Board of Education with "the League of Nations Non-Partisan Association for ten lectures in the city schools on the League of Nations and the World Court." A drive in favor of a plan which has been turned down by the United States Senate receives the recognition of the educators of America but let the military forces attempt any demonstration of any kind and they are denounced as militaristic and tending to create ill-feeling among the other nations. The pacifist's argument is a one-sided one, it must be admitted and yet a telling one, nevertheless. It has reached the heart of the masses. It has won over many of the most brilliant men of the nation. It has found its sought-for mark and now reposes, slowly but surely destroying the foundations of our land. It threatens to crumble the pedestal upon which has been founded this nation, colonized and born by the ocean, and succored by the waters which wash its shores.

Have the tools of pacifism more right in our schools than the representatives of a branch of government founded by the makers of our Constitution? "To create and maintain a navy" this document reads. Shall these newly come advocates of submission cast away the roots from which government springs? If the publicity of pacifism has been successful so shall the publicity in favor of reasonable, yet adequate defense. The schools belong to the government as now organized, not to the government as desired by the prophets of peace, and so must they be taught the true and sane method of protection.

America is not and will not be militaristic. It was recently said that we would some day fight for expansion. Our growing population would demand more ground to live. Such a situation is so far beyond the vision of the generations that live now that it is idle to plan upon a contingency so distant. At present America needs no expansion (except possibly to provide a few footholds from which better to protect our present coast and overseas possessions). To wage an aggressive war would be folly to a nation so well equipped naturally as it is the fortune of America to be. The dollar cannot always buy us protection but it can provide us with additional territory if needed. We desire a navy and an

army solely for our own defense. In our publicity we must overcome the belief that has been instilled by pacifists that a navy's primary object is aggression. Those who have instilled into the minds of our people this doctrine base their theory upon the deeds of other navies than our own. Those nations which have blazed their course of expansion with cannon and fire have risen to their pinnacle and have fallen. We desire no such ignominious end. To live and let live is the principle upon which our nation was founded and we wish but to ensure the endurance of that tenet.

In conclusion it will be wise to touch briefly on the means of accomplishing the end. There are many in the naval service and out of it who are willing and would be glad to be able to aid the Navy in its campaign of indoctrination. At present they sometimes aid and sometimes hinder for the publicity used is haphazard and unorganized. The greatest need in naval publicity is to organize it in a systematic way. Perfect the organization of naval publicists as faultlessly as the pacifists and anti-navy forces are planned. Lieutenant Sampson Scott of the Reserve Force wrote in the PROCEEDINGS in October, 1924:

> Why shouldn't the . . . . Naval Reserve Force act . . . . as a center or gathering point for all interested in the Navy and disseminate facts . . . . concerning the needs of the Navy? Of course, the Navy League is supposed to do this, but what has been done? Probably due to lack of organization and lack of frequent meetings it has accomplished little. There should be some means and some method of informing the country at large of the needs of the Navy—some way of telling the truth to the people and winning them over to the correct viewpoint. . . . .

There are numerous ways of undertaking organized publicity and there are numerous organizations today who attempt to teach the people as to the needs of the Navy and fail in their task. The Navy needs its publicity service overhauled. A new beginning must be made. The wrong must be cast away; the right retained. The profit which will result is worth the endeavor. While others may labor with new-found theories, the naval publicist may be spurred on, backed by the knowledge that his reasoning is best. It is no new-born fancy; no untried plan. It is an age-old condition. Let us, therefore, work that the words of Admiral Coontz may be fulfilled:[1]

> When every citizen of our country shall give the consideration to our Navy that is given by the people of the British Isles, then will we have a force able to protect the weak and defenseless when they need it, and produce national security.

[1] Admiral R. E. Coontz in *Our Navy*.

SQUARING THE TILT

An Application of the Method of Least Squares to Tilt Data

By Lieutenant Lawrence Wainwright, U. S. Navy

THE gunnery officer afloat is frequently confronted with the problem of determining the inclinations and high points of his directors, turrets, and broadside guns. If the data are taken by means of the sea-horizon, as is rapidly becoming the accepted practice, a third quantity, index correction, becomes appreciable. This seems to have been overlooked, probably because it is usually negligible in drydock determination. The method of reducing the data which is given below leads systematically and accurately to a unique evaluation of all three quantities.

Ordnance pamphlets 395 and 396 describe the manner of procuring the data. The gunnery officer is probably familiar with the procedure. It may be well to point out, however, that practice in checking on the horizon improves the accuracy and consistency of the data, so that the data finally used as a basis for setting the compensators should be those obtained after several days' practice. Further, observations should not be made when the angular motion is too rapid, as a time lag in marking will then tend to introduce large errors. This tendency can be minimized by marking on both the up-roll and the down-roll. A lower angular velocity is insured by marking near the end of the roll, and this should be done, but practically, there is not much gain in this direction. The best course is to wait until the roll is not more than a degree or two. As an example, a ship having a roll period of ten seconds, when rolling 5° each side of the vertical, has an angular velocity of about 190 min./sec. at the middle of the roll. A time lag of 1/10 sec. would therefore tend to cause an angular error of 19 min. The angular velocity is directly proportional to the amplitude and inversely proportional to the period.

On page sixteen of O. P. 395 are enumerated four ways of accomplishing the desired reduction. Number three is the method

of least squares, of which it is there said: "A pure calculation involving trigonometrical tables; the computer works entirely in the dark until the last step of the process. There is no indication of how the result is coming out." The criticism is ill-considered and implies drawbacks to the method which are merely visionary. It is due, probably, either to insufficient appreciation of the method, or to failure to apply it elegantly. In the first place, "a pure calculation" is surely preferable to a haphazard graphic method, and the necessity for "trigonometrical tables" is by no means the onerous imposition implied. In the second place, that "the computer works entirely in the dark until the last step of the process. There is no indication of how the result is coming out" is quite irrelevant. When "the last step of the process" has been taken, the desired values are known; before that, they are approximately apparent by a mere inspection of the data. Finally, consider the same remarks when applied to navigation.

The alternative method recommended in O. P. 395 is the customary graphic one. Its use would perhaps be justifiable if the least squares method were very costly of effort, but this is not so. The graphic method, as currently applied to sea-horizon data, usually gives but a poor evaluation of the tilt and the high-point, and ignores the index correction. The values obtained depend upon the experience, skill, and digestion of the draftsman.

The method of least squares is nothing more than a reasoned way of selecting a very probable result from among those offered by a series of discordant observations. It comes by its name quite honestly. The "least square" solution is that one for which the sum of the *squares* of the deviations in the *least*; the deviations being the differences between the selected solution and the

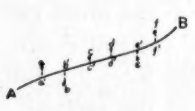


FIG. 1

observations. Thus, in fig. 1, we have a number of observations (a, b, c, etc.) and a "least square" curve (AB) through them. For each observation there is shown on the curve a corresponding point (a′, b′, c′, etc.). The dotted lines (aa′, bb′, cc′, etc.) rep-

resent the deviations. To earn its name of "least square," the curve (AB) must be such that:

$$(aa')^2 + (bb')^2 + (cc')^2 + \text{etc.} = \text{minimum}$$

This principle is due to the famous French mathematician Legendre (1752-1833). It enjoys almost universal acceptance, for though the selection of the most probable curve is apparently a matter of taste, this rule is so simple of conception and application, and conforms so well to our intuitions, that other criteria seldom displace it in scientific work. A reason for *squaring* the deviations is this: Were we to take simply the first powers of the deviations we might construct a very wild curve, indeed, and yet have the sum of the *positive* and *negative* deviations zero. To treat the absolute values of the first powers, i.e., their values independent of sign, would be mathematically cumbersome. The squares are, of course, always positive, and squaring the deviations places a penalty on large ones. When the sum of the squares is a minimum, the curve is constrained to pass amidst the observations.

The form of the equation to which the least square method is applied has a tremendous influence on the simplicity or complexity of the solution. If there is any choice in the form of the equation representing the physical situation, as is usually the case, it is wise to seek one which will render the least square operations as simple as possible. Such is the present case. If we try to adjust the observations to an equation in the form of a sine curve, the calculations will be extraordinarily complex. It is possible that such an attempt led to the remarks quoted from O. P. 395. On the other hand, if we utilize the linear equation of a plane in space, the computations will be very simple. Furthermore, by selecting the bearings on which observations are made, in convenient sets, the work is still further reduced and can even be largely performed graphically. The graphic work, in this case, however, unlike the graphic method just described, involves no element of choice, but is a straightforward process dealing only in straight lines and angles (not circles) and leads to a unique solution whoever the draftsman (granted elementary skill).

We refrain from deducing the formulas, and content ourselves with presenting the results. We give first the simplest and most useful case. For notation, let:

B = relative bearing of observation, measured from the bow, through starboard, up to 360°;

z = angular error observed on each bearing, expressed in minutes of arc, + above the reference plane, — below;

t = tilt or inclination, i.e., angle between the reference plane and the roller path in question, expressed in minutes of arc (always +);

P = relative bearing of "high point," measured from the bow, through starboard, up to 360°;

r = index error, expressed in minutes of arc, + indicating that the index of the roller path in question reads too high, — too low;

Σ = a sign of summation, indicating that there is to be taken the sum of the quantities indicated for all of the observations;

i = a subscript denoting the number of an observation (as first, second, third, etc.) without specifying any particular one, e.g., $\Sigma\, z_i \cos B_i$ denotes the sum of all the z's, each multiplied by the cosine of its corresponding bearing;

n = total number of observations;

e, f, g, etc. = certain quantities defined in the formulas.

Problem: Given n values of z corresponding to n values of B, to solve for t, P, r by the method of least squares.

The formulas are:

$$c = \Sigma\, z_i \qquad e = \Sigma\, z_i \cos B_i \qquad f = \Sigma\, z_i \sin B_i$$

$$g = \Sigma \cos^2 B_i \qquad h = n - g$$

$$t = \frac{\sqrt{f^2 g^2 - h^2 e^2}}{g\,h} \qquad \tan P = \frac{fg}{he} \qquad r = \frac{c}{n}$$

The bearing of the high point (P) will be determined from its tangent. The tangent has the signs shown in Fig. 2. In which of the two quadrants of the same sign the high point lies is easily

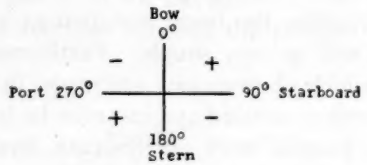


FIG. 2

determined from the trend of the z's. The quantities e, f are readily determined graphically by plotting the z's as vectors, end to end, and measuring the rectangular components of their sum, as illustrated in Fig. 3, taking care that negative z's are laid off in the direction of the reverse bearing.

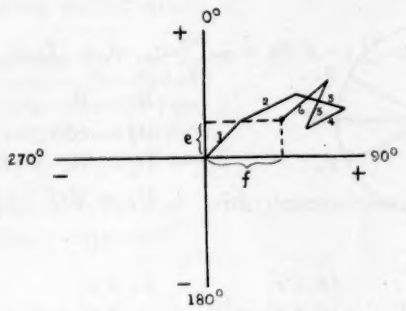


FIG. 3

The quantity is easily determined from Table I, and h is obtained simply by subtracting g from n. The quantity c, is simply the sum of the z's, with due regard to signs.

TABLE I

	B			$\cos^2 B$
0°	180°	180°	360°	1.0000
5	175	185	355	.9924
10	170	190	350	.9698
15	165	195	345	.9330
20	160	200	340	.8830
25	155	205	335	.8214
30	150	210	330	.7500
35	145	215	325	.6710
40	140	220	320	.5868
45	135	225	315	.5000
50	130	230	310	.4132
55	125	235	305	.3290
60	120	240	300	.2500
65	115	245	295	.1786
70	110	250	290	.1170
75	105	255	285	.0670
80	100	260	280	.0302
85	95	265	275	.0076
90	90	270	270	.0000

The foregoing simplified formulas hold only if the bearings are taken in complete sets. A "set" of bearings consists generally of four bearings symmetrically disposed with respect to the thwartship axis (forming, as it were, an X split symmetrically by the axis) as illustrated in Fig. 4. There are two exceptional sets,

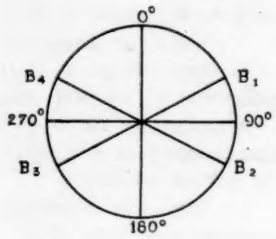


FIG. 4

"Set" of bearings:

$B_1 = B_1$
$B_2 = 180° - B_1$
$B_3 = B_1 + 180°$
$B_4 = 360° - B_1$

namely: (a) The set 0° and 180°; and (b) the set 90° and 270°. If the bearings are selected as multiples of 30°, then g and h will be integers. In Table II is given an example derived from the figure on page 14 of O. P. 396.

TABLE II

i	B_i	z_i	$z_i \cos B_i$	$z_i \sin B_i$	$\cos^2 B_i$
1	30°	+ 19	+16.45	+ 9.50	.7500
2	60	+ 16	+ 8.00	+13.86	.2500
3	90	+ 13	0	+13.00	0.
4	120	+ 12	− 6.00	+10.39	.2500
5	150	+ 13	−11.26	+ 6.50	.7500
6	210	+ 17	−14.72	− 8.50	.7500
7	240	+ 21	−10.50	−18.19	.2500
8	270	+ 23	0	−23.00	0
9	300	+ 24	+12.00	−20.78	.2500
10	330	+ 23	+19.92	−11.50	.7500
10 =n		+181 =c	+13.89 =e	−28.72 =f	4.0000 =g

$n - g = 6 = h$

$fg = -114.9$ $\quad he = +83.34$ $\quad gh = 24$

$t = 5.9$ min. $\quad P = 306°$ $\quad r = +18.1$ min.

In the rare event that the observations are not made in the prescribed sets, the computation is lengthened. The formulas become:

$$t = \frac{\sqrt{F^2 - G^2}}{E} \qquad \tan P = \frac{G}{F} \qquad r = \frac{H}{E}$$

with the additional definitions:

$$H=\sum \cos B_i \quad b=\sum \sin B_i \quad d=\sum \cos B_i \sin B_i=\tfrac{1}{2}\sum \sin 2B_i$$
$$E=adb+bad+ngh-(d^2n+b^2g+a^2h)$$
$$F=cdb+baf+nhe-(fdn+b^2e+cha)$$
$$G=aeb+cad+nfg-(den+bcb+a^2f)$$
$$H=adf+bed+chg-(d^2c+bgf+ahe)$$

For those who are familiar with determinants, E, F, G, H can be conveniently expressed:

$$E=\begin{vmatrix} a & b & n \\ g & d & a \\ d & h & b \end{vmatrix} \qquad F=\begin{vmatrix} c & b & n \\ e & d & \\ f & h & b \end{vmatrix} \qquad G=\begin{vmatrix} a & c & n \\ g & e & a \\ d & f & b \end{vmatrix} \qquad H=\begin{vmatrix} a & b & c \\ g & d & e \\ d & h & f \end{vmatrix}$$

or, more compactly:

$$E, F, G, H=\begin{vmatrix} a & b & n; & c \\ g & d & a; & e \\ d & h & b; & f \end{vmatrix}$$

As an example, we take four of the values from Table II and obtain a solution by the general method. The agreement is rather good, considering that so few observations are used in this latter case. The work is outlined in Table III.

TABLE III

i	B_i	z_i	$\cos B_i$	$\sin B_i$	$\cos B_i \sin B_i$	$\cos^2 B_i$	$z \cos B_i$	$z \sin B_i$
1	30°	+19	+.8660	+ .5000	−.4330	.7500	+16.45	+ 9.50
2	60	+16	+.5000	+ .8660	−.4330	.2500	+ 8.00	+13.86
3	120	+12	−.5000	+ .8660	−.4330	.2500	− 6.00	+10.39
4	150	+13	−.8660	+ .5000	−.4330	.7500	−11.26	+ 6.50
4		+60	0	+2.7320	0	2.0000	+ 7.19	+40.25
=n		= c	= a	= b	= d	= g	= e	= f

$$n - g = 2 = h$$

E = 1.072 F = 3.85 G = −5.84 H = 20.1

t = 6.5 min. P = 303° r = +18.7 min.

It will be noted that the present method will yield a solution when all the observations are on the same side of the ship's center line, a feature practically impossible in the case of the customary graphical method.

CAPTAIN JOHN MANLEY OF THE CONTINENTAL NAVY

By Lieutenant H. E. Dow, U. S. Naval Reserve

JOHN MANLEY was born at Tor Bay, near Torquay, Devonshire, England, in the year 1733, and while still a young man came to America and settled at Marblehead, where he seems to have become a man of some substance, owning, at the time we first find mention of him, besides several fishing vessels, a warehouse and a wharf at Beverly.

There is little record of his early life except that on September 27, 1764, under the name of John Russell, he married a Martha Hickman of Marblehead. By this marriage he had at least two sons and three daughters, who, together with their descendants, were known by the name of Russell. Manley himself, while known by the name of Russell in Marblehead, was elsewhere known as Manley. Unfortunately no reason for this change of name can be found. Manley seems to have lived with his family at Marblehead until he entered the service of the United Colonies, about which time he moved nearer Boston and probably settled in Malden.

The first notice we find of Manley's connection with the Navy is a record in September, 1775, of the schooner *Hannah,* belonging to John Manley of Marblehead, being fitted out and commanded by Nicholas Broughton under a commission given by General Washington, who acted without the authority of the Continental Congress, on his own initiative as Commander-in-Chief of the Army.

About the first of October, 1775, Washington, acting again on his own initiative, ordered Colonel Glover of Marblehead to charter and fit out several vessels to prey on the transport and supply ships of the English then besieged in Boston. Accordingly Glover chartered four small schooners owned in or near Marblehead at the rate of $1.00 per ton per month. He did this in the name of the "United Colonies of North America." These vessels bore the names *Hancock, Lee, Franklin,* and *Warren.*

On October 12, 1775, Washington received orders from the Congress to dispatch two of these schooners to the Gulf of St. Lawrence for the purpose of intercepting two English brigs bound from England to Quebec with military stores. The *Hancock* and the *Franklin* were detached for this service and sailed on October 21 under the command of Captain Nicholas Broughton, ex of the *Hannah,* and John Selman, respectively.

The *Warren,* Captain Waters of New Hampshire, and the *Lee,* Captain John Manley of Marblehead, were directed to cruise off Boston.

General Washington approved Manley's commission on October 17, 1775, and a few days later sent him orders empowering him to "take and seize all vessels bound to or from Boston on the service of the Ministerial Army."

The *Lee* was a half-decked top-sail schooner of seventy-two tons carrying ten swivels and four 4-pound cannon. Twenty rounds of ammunition were provided for each gun. Her crew consisted of fifty men of Colonel Glover's Amphibian Regiment, so called because they were equally at home on sea or land, being all fishermen or sailors from the Essex County coast towns.

On October 29, 1775, the *Lee* sailed under Captain Manley, flying the Pine Tree flag. Manley cruised off Boston with slight success until November 26, when he received information that the English brig *Nancy* with military stores was off the coast alone, having lost her man-of-war convoy. At the time he received this news Manley was taking on provisions at Beverley, but sailed immediately and three days later fell in with the brig about ten miles off Cape Ann. Being lightly armed the *Nancy* struck wthout hesitation and that night Manley brought her into Fresh Water Cove in Gloucester outer harbor. The value of the prize proved to be more than £20,000, a large amount for those days, and her cargo was of great value to the Continental Army which was almost destitute of military stores.

During the month of December, 1775, Manley took four more vessels totaling 900 tons and of considerable value. In the same month Captain Manley had risen from comparative obscurity to a position as one of the young nation's most noted naval officers. As an enthusiastic citizen wrote, "as many towns contend for the honor of his birth as they did for that of Homer's."

That Washington appreciated Manley's ability and aggressiveness is shown by the fact that on January 1, 1776, he appointed him commodore of the armed schooner force. Manley hoisted his flag on the *Hancock,* about the same size as the *Lee* but faster. The other vessels of his force were the schooners *Lee,* Captain Waters, *Franklin,* Captain Tucker, *Harrison,* Captain Dyer, *Lynch,* Captain Ayers, and *Warren,* Captain Burke. About this time these vessels were placed under the authority of the newly-organized Marine Committee of Congress, thus becoming the real embryo of the United States Navy.

On January 25, 1776, Manley, cruising off Boston, sighted the ship *Happy Return,* 130 tons, Whitehaven to Boston and, giving chase, took her in full sight of the English fleet at anchor in Nantasket Roads. Putting a prize crew on the *Happy Return* he started to convoy her to Plymouth but off Cohasset he sighted a Boston bound brig. Bearing down on her she struck her colors to him, proving to be the *Norfolk,* 120 tons, Captain Grindall, Whitehaven to Boston. Putting a prize crew on the *Norfolk* Manley was about to continue with his two prizes when he sighted a British armed schooner and convoy of two small provision vessels coming rapidly toward him.

In spite of the fact that the English schooner was more heavily armed than the *Hancock* and was full of men while the *Hancock,* having depleted her crew to man the two prizes, had only two officers and sixteen men left aboard and in addition was full of prisoners from the prizes, Manley hove her to and waited for the enemy. When the English schooner came up a sharp engagement took place. Strange to relate the prisoners lent considerable aid, and as Manley said in a letter written shortly after this event "Did as much as they dared do in such circumstances." After a short encounter the enemy sheered off and continued to Boston, while Manley, seeing the English frigates in Nantasket Roads were getting under way, made what speed he could for Plymouth, where he arrived on the ensuing evening, being able to report no greater casualties than one man wounded and some slightly damaged rigging.

A few days later he received a letter from General Washington which in closing said:

> I wish you could inspire the captains of the other armed schooners under your command with some of your activity and industry. They dare not

disobey your orders as it is mentioned in the instructions I have given them that they are to be under your command as Commodore, and as such I desire that you will give them such instructions, in writing, as to you will appear for the good of the service.

I am, sir, wishing you a continuance of success, yours etc.

George Washington

On January 30, 1776, he encountered an English frigate outside the Gurnet and knowing it to be useless to engage a vessel of such superior force, fled up the coast, but finding the frigate to be gaining on him rapidly he put the *Hancock* aground just south of the North River in Scituate. The frigate approaching as near as her draft would allow came to anchor and poured such a heavy fire on the *Hancock* that Manley and his crew left her and waded ashore. Lowering their boats the English stood in to board the *Hancock,* but the militia of the neighborhood having joined Manley and his men, such an array was presented that the English returned to their ship, weighed anchor and stood up for Boston. The following day Manley refloated the *Hancock* and on February 1 was ready for sea again.

Manley is reported as having taken several prizes, totaling 700 or 800 tons, during February and March, 1776, and on April 17 we find that Congress appointed him to command the 32-gun frigate *Hancock,* then building at Newburyport. This was one of the seventeen frigates authorized by Congress by the Act of December 13, 1775. Through delays in building and fitting out Manley was unable to put to sea in his new command until April 24, when he left Boston in the *Hancock,* flag, in company with the frigate *Boston,* twenty-four guns, Captain McNeil, to search for an English frigate which was capturing American vessels off the Massachusetts coast. On the morning of the 28th, Manley sighted a sail which proved to be an English frigate of about the same size as the *Hancock.* The two ships approached rapidly and passed close enough to exchange broadsides. The British vessel did not wish to continue the engagement but crowded on sail to escape. Manley came about in pursuit and as soon as in range opened an engagement which lasted about an hour and a half when the *Boston* came up and the Englishmen struck his colors proving to be the *Fox,* twenty-eight guns. Manley lost eight men in this engagement while thirty-two were killed on his prize.

About the 1st of June, 1777, the three ships, *Hancock, Boston,* and *Fox,* imprudently appeared off Halifax. This move brought out three English frigates, the *Rainbow,* forty-four guns, *Flora,* thirty-two guns, and *Victor,* eighteen guns, then at anchor in the port.

The American ships scattered and the *Boston* having a good start escaped. On arriving at Boston, Captain McNeil was court martialed and dismissed from the service for abandoning Manley under such serious circumstances. The *Flora* quickly overtook the *Fox* and after a short engagement captured her. The *Rainbow* and *Victor* gave chase to the *Hancock.* The wind being light Manley tried to lighten his vessel by pumping tanks and bilge, but only succeeded in so putting his ship out of trim that she became practically unmanageable. Seeing that he could not escape Manley tried to bring his ship about and board the *Rainbow,* but before the maneuver could be completed the *Rainbow* was on him and the *Victor* in raking position. Finding himself in a hopeless situation Manley surrendered and was taken prisoner to Halifax. It is not known how long he remained prisoner, but on December 14, 1778, his name appears as being in command of the privateer *Cumberland,* 20 guns. In January, 1779, the *Cumberland* sailed from Boston and proceeded to the West Indies. She was taken by the English frigate *Pomona* and carried into Barbadoes, where Manley and his officers were imprisoned without any of the indulgences usually offered to officer prisoners of war. About a month later they escaped by bribing the jailer. Seizing a sloop in the harbor they made their way to Martinique, from whence they obtained passage to Boston, arriving in April. On June 2, 1779, Manley received command of the privateer *Jason,* eighteen guns, of Portsmouth, proving that in spite of his having lost two vessels, his ability as a naval commander was still respected. On June 22, the *Jason* left Portsmouth and on the same day sighted two sails. These proved to be an English frigate and brig. Faced by such a superior force Manley came about and crowded on sail for Portsmouth. The enemy gained rapidly, but off the Isles of Shoals a heavy thunder squall struck in from the west and hove the *Jason* aback, after a few moments the wind shifted sharply north carrying away nearly all the sails that had not been furled. The wind then shifted suddenly again to the east throwing the ship on her beam ends and dismasting

her. The two Englishmen were driven out to sea and disappeared.

During the squall one of the crew of the *Jason* was knocked overboard and drowned, and this together with the fact that Manley had lost two vessels, caused his crew to consider him a Jonah and, mutinying, they refused to do any work unless the ship were returned to Portsmouth which would give them a chance to desert. When Manley received word of the munity he seized the cutlass of the sentry at his cabin door, and, running down the deck, singled out the ringleaders of the mutineers and punished them to such a good purpose that within thirty-six hours the masts were restepped, topmasts and topgallant masts on end, lower yards athwart, topsail yards on caps, sails bent, and running rigging rove. After completing his repairs Manley continued his cruise and a week later appeared off Sandy Hook.

On July 23, 1779, Manley in the *Jason* fell in with the privateers *Hazard,* eighteen guns, of Liverpool, and *Adventurer,* eighteen guns, of Glasgow, taking them both after a brisk engagement in which he lost only one man. Manley brought his prizes into Boston, but anchored off Hull and had his stores boated down to him, not daring to bring his ship up to the city for fear the crew would desert. On July 30, he put to sea, and up to September 30 had sent in several English merchant ships as prizes. On the morning of September 30 an English frigate was sighted and Manley made all sail to get away until about 11 P.M. when the Englishmen came up with him. Quoting from the journal of one Joshua Davis, who was on board the *Jason* at the time:

> On hailing we found her to be the *Surprise* frigate, twenty-eight guns. They hailed us and we answered the *Deane.* They ordered us to heave to or they would fire into us and we replied "Fire away and be d—d, we have got as many guns as you." They gave us a broadside. Captain Manley would not let us fire until they got abreast of us. They gave us another broadside which somewhat cut up our running rigging and drove some of our men from the tops. We gave them a broadside which silenced two bow guns. Both sides continued the fire until one in the morning. Our running rigging, yards, and spars were so cut away they were useless. Lanterns were hung at the ship's sides between the guns, but they soon fell on deck at the shaking of the guns which made it so dark the men could not see to load. They broke the fore hatches open and ran below. Our captain sent the sailing master forward to see why the bow guns did not keep the fire up, but he never returned. The captain then sent the master's mate on the same errand and he never returned. It was, therefore, thought needless to stand out long and the captain took the trumpet and called for quarter. The fight lasted two glasses and some minutes.

The *Surprise* was much stronger than the *Jason* having twenty-eight guns and 230 men against the *Jason's* eighteen guns and 170 men, yet on the *Surprise* fifteen were killed and thirty wounded while on the *Jason* only five were killed and a few wounded. The *Surprise* took the *Jason* into St. Johns, N. F., where Manley and his crew were kept until the first of November, when they were taken to England, and placed in the Old Mill Prison, being confined there for a little over three years. Early in January, 1782, Manley was exchanged and, making his way to France, obtained passage on a French letter of marque bound for America and on April 1 of the same year was again in Boston. On September 26, 1782, the *Independent Chronicle* of Boston bears the following notice:

> On Monday the 11th inst. John Manley, Esq., captain in the American Navy, was appointed to command of the Continental frigate *Hogue* (late *Derne*), now in the harbor, agreeable to an order from the Hon. Robert Morris, Esq., Principal Agent of Marine. Captain Manley, at two P.M. of the same day repaired on board, attended by his principal officers, and was welcomed with united acclamations, thirteen guns were fired in honor of his appointment, the ship beautifully decorated with colors, and every possible demonstration of joy expressed a general satisfaction.

After taking command of the *Hogue* Manley put to sea for an extended cruise in the West Indies. Of this, his last cruise during the Revolution, little is known beyond the fact that by January, 1783, he had sent in five prizes.

About the middle of January of that year the *Hogue* was chased by a 50-gun British ship, and after keeping clear for thirty-six hours, had the misfortune to ground. The Englishman coming up was reinforced by three other ships of the line, one of them a 74, and all four vessels, anchoring with springs on their cables within gun shot, opened a tremendous fire. For two whole days the *Hogue* withstood and returned the fire, but on the third day Manley, succeeding in refloating his ship, fired a 13-gun salute, and made good his escape.

Quoting from a letter which he wrote about this time from Gaudaloupe to friends in Boston:

> I have been drove on shore after a 36-hour chase by a 50-gun ship and sat at the mercy of her incessant fire for two days, who with the assistance of a seventy-four and two other ships of the line to back her were not very sparing of a heavy and brisk cannonade. However, without a man killed and one slightly wounded and my damages repaired in masts and hull it is

with pleasure I look to the prospect of getting out tomorrow for Martinique Port Royal for heaving down.

With this anecdote the clear story of Captain John Manley's naval career comes to a close. It is known he paid off the *Hogue* in Boston sometime in May, 1783, and also that he remained in the Navy until his death in 1793, but of his activities during the ten years of his naval service that followed the Revolution nothing definite can be found.

We do know that he had the signal honor of taking the first and last valuable prize taken by a Continental ship during the War of Independence, receiving, on one of the last days of November, 1775, the surrender of the brig *Nancy,* 250 tons, while in command of the tiny schooner *Lee* and eight years later in November, 1783, he took the ship *Baille,* 340 tons, while in command of the frigate *Hogue.*

In spite of the fact that he lost three ships entrusted to his command, that at times his judgment was not of the best, as is witnessed by his ill-fated appearance off Halifax in June, 1777, he undoubtedly was possessed of great courage, initiative, and determination.

His exploits were sparkling with daring, boldness, skill and not without an occasional dash of sarcastic humor. One can still chuckle over the baffled wrath of the commanders of that British squadron when the saucy rebel sailed on his way with his 28-gun frigate, herself taken from the British, firing a 13-gun salute of farewell to rub it in. His whole career makes him worthy of a place in United States naval history little lower than that occupied by John Paul Jones himself, as a founder and maker of those fine traditions that make the Navy what it is today.

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AUTHOR'S NOTE: The quotations in this article are as they appear in the printed *Historical Collections* of the Essex Institute, Vol. XLV, 1909. I believe most of the original manuscripts from which the quotations are taken are in the possession of the Essex Institute at Salem, Massachusetts, but the opportunity has not presented itself for me to examine them.

DISCUSSION

Diesel-Engined Warships

(See page 900, May, 1926 PROCEEDINGS)

CAPTAIN H. C. DINGER, U. S. NAVY.—This article is most interesting particularly as the author treats the subject in a very rational and practical manner and presents no claims for the Diesel that may not be reasonably expected. The Diesel cruiser is a possibility, but as yet unlikely in the near future. As the author clearly states the weight including that of fuel can not be brought down to that which is present with the best designed steam plant. Furthermore, with the adoption of certain entirely feasible improvements the fuel consumption of the steam plant can be reduced materially; so that the Diesel economy as compared to the turbo-reduction gear will be as 4 is to 7.

There are a few statements in the article that call for some comment. On page 909 it refers to the fact that it required the *Richmond* an hour to work up to 30 kts. speed and implies that it required that long to start the engines. The Diesel-engined vessel would also require some time to work up to speed of 30 kts.; not as long as the steam plant but certainly half an hour. At least that is what I would expect from my experience in command of a Diesel-engined vessel and experience with submarines. On page 911 it is stated that a steam vessel would require at least three hours to set her steam plant going. It is frequently done in one hour in the U. S. Navy and I have seen it done in twenty minutes in a emergecy. The Diesel of course would have a big advantage in this connection but not as great as seems to be indicated.

In regard to the Diesel electric-drive cruiser installation, in my opinion this is the first practical step toward introducing the Diesel on cruisers or other high speed vessels. By its means the cruising radius can be doubled at low speeds and it also has numerous other advantages in enabling the steam plant to be overhauled at sea, reducing the need for extra ship's generators, being ready to get underway quickly without disclosing preparations, etc. I have recently checked up the extra weight required by a 3,000 H. P. Diesel Electric cruising installation in a 10,000 ton cruiser and find it can be done within 200 tons, if the type of Diesel engine now being built for the new U. S. submarines is used. Here also it is not advisable to skimp weight at the expense of reliability.

The hydraulic reduction gear, if successfully developed and without undue addition of weight, presents very material advantages over either the electric-drive or mechanical reduction gearing in connection with the high-speed Diesel engine proposed. As to reliability of this type of motor for

exclusive main drive, our experience on submarines has so far indicated that there is still something to be desired. However, with a little more experience and experimenting increased reliability should be forthcoming so that in the near future this type of motor may be considered reliable. The real drawback to the use of the Diesel engine on high-powered naval vessels is the weight required.

The Determination of the Compass Error

(See page 1492, August, 1926 PROCEEDINGS)

COMMANDER ARCHER M. R. ALLEN, U. S. NAVY.—This article is excellent. It is in reality merely a description of the combination of two other methods, ranges, and a distant object, but the method employed (particularly the course suggested), is very good indeed. The determination of the magnetic bearing by use of the mean of all headings is standard practice here at the Naval Academy. The use of a marker in a boat anchored off a lighthouse is another good suggestion if the weather happens to be calm and the sea smooth.

In this connection it is well to draw the attention of naval navigators to the fact that the merchant navigator pays more attention to the determination of his compass error and the rectification of his courses. There is as yet no known standard continuous record of the operation of the compasses, both magnetic and gyro, in use in the naval service. There is the regular gyro log and the compass record, but the navigator's record of the frequent checks, errors, and corrections, is left to the inclination of the individual. Comment on this subject would be most welcome and interesting.

Squaring the Tilt

(See page 1547, August, 1926 PROCEEDINGS)

LIEUTENANT E. E. HERRMANN, U. S. NAVY.—Lieutenant Wainwright, in his article, "Squaring the Tilt," offers a criticism against the well known and commonly used graphical methods of solving for the inclination and high point of a roller path, and presents a purely mathematical treatment of the problem. This mathematical treatment, however, appears to be open to at least as much criticism as the graphical methods.

Lieutenant Wainwright suggests that the least square method has not found greater favor because of "insufficient appreciation of the method, or failure to apply it elegantly." But he also criticises the graphical methods because "the values obtained depend upon the experience, skill, and digestion of the draftsman." It seems altogether inconceivable that a person who is not experienced and skillful enough to make proper use of a simple graphical method will have any better success with a somewhat obscure mathematical process. It must be conceded that the method of least squares is not one with which the average naval officer is well acquainted. If ability to use the method is to be the criterion, then the argument lies greatly in

favor of the graphical methods. Graphical methods are, as a rule, well understood. Experience has demonstrated that for most practical problems graphical methods are usually the simplest, the most rapid and often also the most "fool-proof."

In determining the inclination and direction of the high point of a roller path, a series of observations is made. The inclinations are actually measured on several bearings, and the problem then becomes one of passing through these observed points the plane which fits them the most accurately. If this could be done graphically in three dimensions, the plane would actually be constructed. But the graphical methods usually use either of two systems of coordinates based on two dimensions, viz., rectangular or radial. If rectangular coordinates are used, the inclinations of the roller path plot as a sine-curve; if the radial method is used they plot as a circle. But in either case the regular curve will be obtained only if the roller path is a true plane. In either of these methods the problem is to pass the curve (sine-curve or circle) through the plotted points in such a manner as to fit them the most accurately. Since observations will always be in error to a certain degree, a curve drawn so as to pass through all of the plotted points will not usually represent a true plane; it will not be a regular curve of any type, and, in some cases, may be decidedly irregular. This situation is handled in the ordinary graphical procedure by what is commonly known as "fairing" a curve through the plotted points. If the required graph is to be a sine-curve, a sine-curve must be drawn that best fits the plotted points; or if it is to be a circle, the circle must best fit the plotted points. In graphical procedure this is accomplished by trial and error. The accuracy of the final result may depend greatly upon the skill of the draftsman if the observed results are very discordant. More often, however, it is an exceedingly simple matter to draw a good curve.

Lieutenant Wainwright offers a mathematical method for accomplishing this "fairing off" process, based upon the method of least squares. Theoretically there can be no question as to the relative accuracy of the graphical and computational methods. The computational method will give a precise result, while the graphical method may allow errors due to faulty judgment on the part of the draftsman. But how great may these discrepancies be? The inclination of roller paths is rarely as great as 1°, and for turret guns it is usually less than 20′. This inclination is compensated only to the nearest whole minute in turrets, and in smaller guns it is usually satisfactory to compensate it to the nearest two minutes. In other words, an error of the order of about 5 per cent is tolerable in this sort of work. It does not require unusual skill to execute a graphical process to such a degree of refinement. For example, let us apply the rectangular method of plotting to the data given by Lieutenant Wainwright in his first example. The result is illustrated in Figure 1. The figure has necessarily been drawn to small scale, and hence illustrates a much smaller degree of accuracy than may ordinarily be obtained. But even this simple,

free-hand sketch gives the results, t= 6′, P= 300°, and r= 18′, as compared with the computed results, t= 5.9′, P= 306°, and r= 18.1′. It will be observed that the so-called index error, *r*, is found quite naturally by this method of plotting. Why Lieutenant Wainwright states that it is ignored in the graphical methods, is not apparent.

It is true that the rectangular method does not lend itself readily to a situation in which only a few observations are available. The radial method is more suitable, perhaps, in such a situation. But the computational method is likewise greatly complicated when observations cannot be made in regular sets, and becomes exceedingly laborious under these conditions. In such situations various expedients may be used by means of which the graphical methods may be applied very successfully. It will rarely occur that both the high and low points will be so located that the gun may not be

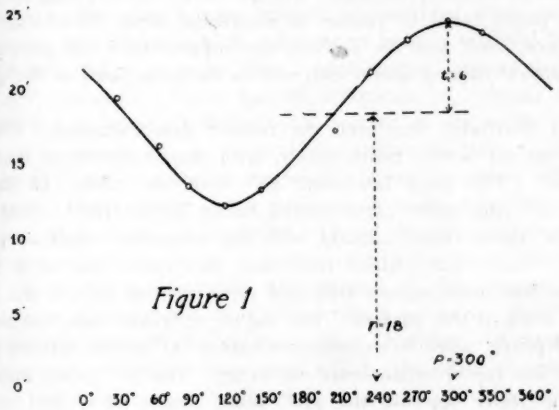


Figure 1

trained on one of them; likewise, one of the neutral points is usually clear for observation. If the gun can be trained in the vicinity of either the high point or the low point, and of one of the neutral points, a series of observations at small intervals around these points will establish the entire curve quite accurately. Whatever other bearings are available for observation may be used as a check on these two points, but it is not strictly necessary to make observations on more than the high point (or low point) and a neutral point.

There is a serious objection to the purely mathematical method for constructing the roller path curve. If it were certain that a roller path is always a perfect plane the mathematical method would be adequate. Roller paths are supposed to be perfect planes, and the type of inclination compensator that is now used to correct for roller path inclination is designed to correct properly only for a roller path that is a perfect plane. But a roller path may, nevertheless, deviate from the true plane at some points, and often does. If a roller path is slightly warped at one sector, the inclinations observed in that sector will apparently be discordant with other

observations, but, in reality, they will be true observations. If the observed inclinations on such a roller path were plotted, no sine-curve could pass through all the plotted points. But a sine-curve could be drawn to fit satisfactorily all points except the decidedly discordant ones. The discordant points would lie outside the curve, and properly so, for their points on the roller path also lie outside the plane that represents the greater portion of the roller path. In a graphical representation such a warp in the roller path would at once be apparent. But in the computational process this feature would not be nearly so apparent, except to a person of considerable experience, unless the points were first plotted. It might be entirely incorrect to use the faulty points in the mathematical method, for by so doing the actual and true errors of the roller path at these points would be used as observational errors, part of the error would be used as a correction to all other observed points and the entire curve would be in error. The faulty points could, of course, be eliminated from the others, but this would at once inject into the problem the judgment of the computer, and the mathematical method would then rest on the same basis as the graphical method.

Figure 1 illustrates very well the feature just discussed. The curve, as drawn, fits all plotted points nicely, with the exception of that on the bearing 210°. This point lies about 12° from the curve. If this error were split, i.e., the entire curve moved bodily to the right about 6°, the result would agree almost exactly with the computed result as given by Lieutenant Wainwright (which illustrates once more how little is to be gained over the commonplace trial and error method by the use of least squares in work of this nature). But the curve would then less accurately fit all other points, with the exception of that at 30° which it fitted about as well under one condition as under the other. The 30° point, incidentally, being diametrically opposite the 210° point, might be subject to a real error also, and it actually is found somewhat off the regular curve.

According to the graphical solution we would set the inclination compensator for 6′ at 300°, and would correct for the errors actually observed on all bearings except 210° and 30°; there would then be residual errors on these two points, about 1¼′ at 210° and about ¼′ at 30°. According to the computed solution we would set the inclination compensator for 6′ at 306°, and would thus correct with less accuracy at all points, although the differences would be immaterial in this case. With a more pronounced warp in the roller path, a considerable inaccuracy might be introduced by the computational method, unless the faulty points were disregarded. The writer has actually observed roller paths in which the warp was very pronounced, making a single mean setting of the compensator impossible without leaving large residual errors on practically all bearings. In these cases the compensator was set to correct for the greater portion of the roller path (the plane portion), and the residual errors on the warped points were compensated by means of an arbitrary setting of the dip-ring (Vickers).

There may be great difference of opinion as to the reason for greatly discordant observations in connection with roller path data; some hesitate to attribute the discrepancies to warping of the roller path. But the discrepancies are found, nevertheless, and may be large. Points which appear to be greatly discordant are usually rechecked a number of times, and hence there is little likelihood left that they are discordant as a result of observational errors. This is another advantage of plotting observations as they are taken; by the rectangular method the plotting may be done very conveniently as the observations are taken, and the probability of large observational errors thus greatly reduced. But regardless of the cause of a decidedly discordant result, such as the 210° point in Figure 1 for instance,—even granting that it might be due to an observational error,—there is no good cause for penalizing all other points for the sake of one bad point. In a situation of this nature the mathematical method is at fault, for it cannot discriminate between one kind of error and another. The judgment of the person with the work in hand is essential to a logical result, and is bound to be better than a mathematical process which cannot exercise any judgment. There may be difference of opinion, also, as to the desirability of leaving a large residual error in one sector of a roller path. In some cases it may be preferable to reduce the large residual errors in one sector at the expense of comparatively small residual errors in all other sectors. If the faulty sector were one in which firing is often done, such a procedure would be desirable. If, on the other hand, the faulty sector were nearly dead ahead or dead astern, it might be more desirable to leave other sectors accurately compensated at the expense of larger residual errors in the sector in which firing is unlikely. Here again the judgment of the gunnery officer must come into play. A graphical plot of the situation indicates at once what will be the effect of making small changes in the compensator setting, and whether the changes will better suit the particular situation.

The entire problem of measuring roller path inclinations is a very practical one. The work is tedious and requires the services of many officers and men. A ship must often go to a protected anchorage to do the work, and, perhaps, wait for favorable weather conditions. In drydock there is a definite limit to the time during which the work may be done, and it is usually short. All of these factors make it highly desirable that the methods employed be the most expeditious. It is difficult to foretell what the conditions will be,—whether it will be possible to take readings in 'sets,' as suggested by Lieutenant Wainwright. On small ships, especially, the anchorage is often such as to provide bearings only in limited sectors. While the personnel of a ship might grasp the simplified method offered by Lieutenant Wainwright, which is good only for certain ideal situations, it is extremely doubtful whether they would be able to adapt the least square method readily to conditions as they arise. An answer must be available in short order, for a change in the inclination compensators should always be followed at once by a check. For the purpose of getting the

answer rapidly no more satisfactory method is available than the rectangular method of plotting, for it requires but a pencil and a piece of plotting paper, and a good solution may be made rapidly at the scene of the work.

Lieutenant Wainwright refers to the inability to make observations in the required 'sets' for his simplified process, as a 'rare event.' This may be true in the case of turrets, but in the case of broadside guns the opposite is very often the case. For broadside guns, which are, incidentally, the more numerous, the longer computational procedure would often be required. This longer procedure, as illustrated by Lieutenant Wainwright in his second example, requires about seventy operations for only four bearings of a single gun. If there were any great advantages to be derived, this labor might be justified. But, as pointed out previously, it is doubtful whether there would be any advantage at all, for the mathematical method does not lend itself nearly so well to the introduction of judgment as does the graphical method. Whether an expert mathematician can, by computation, construct a better roller path curve than the average naval officer can construct by graphical methods, having due regard for the magnitude of the quantities involved and the degree of accuracy required, remains to be proved.

There are various other practical considerations, besides those mentioned, which militate against the use of any purely mathematical method in connection with roller path work. To discuss all of these various features would lead to lengthy descriptions of situations under which the work is usually done, for which space is not available here. But many of these features will be apparent to those who have checked directorscopes at sea under the conditions usually found during a period of gunnery exercises. In saying that the criticism against the mathematical method is "ill considered and implies drawbacks to the method that are merely visionary," Lieutenant Wainwright has, perhaps, lost sight of the great preponderance of practical considerations over a few theoretical and doubtful advantages.

Post Treaty Naval Design

(See page 2125, November, 1925 PROCEEDINGS)

CAPTAIN E. F. EGGERT (CC), U. S. NAVY.—The authors have reopened this question in such a way as to make a reply desirable. Setting aside entirely questions of opinion as to the usefulness of a type of vessel described as the *Indomptable,* it is proposed to go a little more fully into the facts and figures of design.

First, in order to determine what is necessary to make a ship able to meet the *Indomptable,* it is well to know a little more about the latter. For lack of information, speculation only is available.

The vessel is described by the authors as of 17500 Treaty tons, lightly armored, with a main battery of eight 12 inch guns in two turrets, the guns firing a 970 lbs. projectile of high velocity. The speed is to be 34 knots.

The 1906 French 12 inch gun as described by Jane is of forty-five calibers, weighting fifty-five tons, with a powder charge of 282 lbs., and a projectile of 960 lbs., with a muzzle velocity of 2559 f.s. This is not a high velocity gun. If the velocity were increased to 2800 f.s., it might be so considered, especially for a projectile of such great weight. In that case, the powder charge would have to be at least 350 lbs. The gun would be as large and heavy as a 14 inch-45cal. gun, and the turret dimensions would approach those of the 14 inch turret. There does not seem to be any clear reason for this unusual type.

Assuming lighter armor, it is estimated that the two gun positions on this vessel, complete with armor, guns, barbettes, and ammunition, would weigh 3000 tons.

Assuming a length on the waterline of 725 feet, and 2000 tons extra for fuel and water at the trial speed of 34 knots, we find that, at 55 per cent propulsive efficiency, about 135000 SHP would be required. For light scout machinery, at fifty SHP per ton, the machinery weight is 2700 tons. This takes no account of the cruising Diesel said by the authors to be included in the design.

The weight of the hull and fittings must be kept small, although with the great length the stresses will be high. A weight of 35 per cent of the trial displacement is assumed. This is decidedly below American practice for such long vessels. There is then available as follows:—

Hull and Fittings	6800 tons
4 inch Protective Decks	2500 tons
2 Turrets complete	3000 tons
Secondary Battery with Ammunition	500 tons
Propelling Machinery	2700 tons
Equipment and Stores	1000 tons
	16500 tons
Leaving for Side Armor	1000 tons
Treaty Displacement	17500 tons
Fuel and Water	2000 tons
Trial Displacement	19500 tons

The 1000 tons for side armor will allow a belt of 6 inches mean thickness, or about 6¼ inches maximum, eight feet wide, 550 feet long, not very much for a capital ship.

The above characteristics are entirely speculative, but they allow us to obtain a better idea of what the ship might be. Thus, the high speed will require a fine midship section, and this, together with the limited hull weight, will make torpedo protection out of the question. The freeboard must be kept down for lack of weight. Other unfavorable results can be foreseen. Of course, the armor and the deck weight might be less than assumed, or the guns smaller, as they well might be, and the ship still fulfill her mission of destroying scouts or merchant vessels.

We now can see more clearly what must be done to defeat such a ship. Let us not however run away with the prevalent idea that material alone wins battles. It would seem of course that one treaty cruiser would, when opposed to one *Indomptable*, find it difficult to make any impression and to come away with a whole skin. The little navy with the lone *Indomptable* would find that the big navy could oppose a number of cruisers, and proper cooperation might readily prove too much for the single raider.

It would not seem to be hopeless, when a considerable number of 8-inch guns are brought to bear, to get some results. The vulnerable part of the raider is his mobility, and even smaller guns than 8-inch might do something toward lowering that, if there were hits enough. It is not probable that the raider would stay at extreme range, if he could close with an 8-inch gunned vessel. It would take too much ammunition. There should be opportunity for a number of effective 8-inch hits, even at long range, and the unarmored ends, smokestacks, or steering gear might be damaged enough to cut several knots off the raider's legend speed, or a considerable amount off his radius of action, and a destroyer attack might then be pressed home.

With regard to large ships, the authors seem to believe that I have said that a 35,000-ton ship cannot be built to defeat the *Indomptable*. That is hardly correct. They wrote definite specifications for such a ship, which I said could not be carried out. Let me quote the authors: "Within the maximum quota of displacement allowed by the treaty, it should be possible to create a vessel (a) armed with six 14-inch or nine 12-inch guns, (b) driven at 36 or 37 knots with engines of 240000 SHP, and (c) protected by eleven to five-inch waterline armor, five-inch decks, and twelve to nine-inch gun positions."

That is a definite proposition, if we assume, as I did, that usual American practice as to hull and machinery scantlings and characteristics be followed, and that armor dimensions and distribution be interpreted as is our practice. Under these assumptions all the specifications could not be met. This is perhaps best shown by further tables of weights showing what could be done.

The 36-knot ship of 35,000 Treaty tons, or, say, 37,000 trial tons, requires a length of about 880 feet on the waterline. On that length, on a trial displacement of 37,000 tons, the speed of 36 knots can be attained with a SHP of 240,000, assuming a propulsive efficiency of 55 per cent. The ship, lengthened to 900 feet on the waterline, will reach 37 knots with a SHP of 300,000. With such great powers to be developed, a heavy type of machinery would be used, at say 30 SHP per ton. The machinery weight will then be 8,000 tons for 36 knots maximum, or 10,000 tons for 37 knots maximum. Making other estimates in a similar manner as before, we have:

Speed	36	37
Length	880	900
Hull and Fittings	14,000	14,500
Propelling Machinery	8,000	10,000

Deck Armor	5,300	4,300
Side Armor	3,000	1,700
2 Turrets and Ammunition	3,300	3,300
Secondary Battery & Ammn.	400	
Equipment & Stores	1,000	1,200
Total Displacement	35,000	35,000

The side armor is 700 feet long, only twelve feet wide, in the first case it is 9.5 inches mean thickness, in the second case only 4.8 inches thick.

The deck armor is 5 inches thick in the first case, but only 4 inches thick in the second case.

Even the first case does not comply with the authors' specifications. The hull is somewhat reduced from the standard. The armor belt is nearly of the thickness specified, but is only twelve feet wide, instead of the American standard of seventeen and one-half feet. The secondary battery is weak. The second case departs much more from the specifications. There is not even a secondary battery.

But these departures are not such as to warrant the fear that the 35,000-ton ship "cannot be better armed, better protected, and faster, than an adversary only half her size." The first case is better armed, better protected, and faster. The second case is better armed, since it carries six 14 inch-50 guns, it is much faster, but it is not better protected except that it is twice as large as the raider, and therefore takes more punishment to disable. High speed is expensive.

The large ship seems, when the speed is 37 knots, to have but little advantage over her smaller antagonist. This is due to the lighter type of machinery in the smaller ship, and the lighter hull, which makes her less reliable, less enduring, less speedy relatively, in the long run, and which responsible authorities would be unwilling to risk in the large ship. If it were not for this difference, the comparison would be much more favorable to the large ship. Actually, as compared to the raider, it must be assumed that the difference in speed is greater than shown in these figures, and this is true also of the speed after battle damage is received.

Personally, I am inclined to believe in the moderate sized ship, whether capital ship or cruiser, and I should prefer to multiply their numbers. My choice of a reply to this raider type would be perhaps as follows:

Length 750 feet.
Speed 35 knots.

HULL WEIGHT	8000 tons
Machinery	3,100
4" Decks	2,900
Five Turrets, etc.	5,000
Equipment	1,000
Treaty Displacement	20,000 tons

This is a single purpose vessel. There is no secondary battery, no side armor, but a more rugged hull. The machinery is of the light type.

The turrets are triple 12", firing standard projectiles of moderate velocity, but with high angle of elevation, and able to reach well over 30,000 yards range. The vessel would naturally prefer long range. At 20,000 yards she need not worry over the absence of side armor, especially if fighting end-on.

As this class is supposed to belong to the big navy, to meet the lone raider of the little navy, she would of course have consorts. The hunters would run in packs, and Nelson's dictum would be fufilled—"Numbers only can annihilate."

Summary of German Submarine Operations in the Various Theaters of War, 1914-18

(See page 621, April, 1926 PROCEEDINGS)

MAURICE PRENDERGAST AND R. H. GIBSON.—When delivering his lecture, under the above title, at the German Admiralty, Captain A. Gayer (German Navy) remarked that his discourse would only be a "condensed résumé" of U-boat operations during the World War. The lecture admirably accords with its author's description. It is, in the main, a synopsis of Captain Gayer's monumental work, *Die deutschen U-Boote in ihrer Kriegführung, 1914-18.* These three volumes form the standard work of reference in their particular subject. The lecture is, however, a more concise and convenient form of reference than the "three-decker" history, and should therefore be put on file by students of war history.

It is regrettable that so informative a discourse should have been marred by inaccuracies in facts, and by ambiguities in phraseology. Whether these errors appeared in the original lecture, or whether they developed during the course of translation, the present writers are not able to discern. Lest false references, and false conclusions, should be drawn from the published translation, we would beg leave to indicate certain errors of the press. And while paying all tribute to Captain Gayer, as a sound and careful chronicler of facts, we would like to indicate sundry matters, wherein he lies at fault. We confine ourselves to questions of fact; of date and event. We decline to enter into any discussion of inferences and general conclusions, such as, for example, the morality or non-morality of submarine warfare against commercial shipping.

First of all, here is a typical ambiguity of expression. Towards the foot of p. 623, Captain Gayer alludes to U-boat operations in the terminal months of 1914. He mentions "certain eventful cruises, which paved the way for other operations later on, namely, the first cruise through the Dover Straits by the *U-eighteen*, under Lieutenant Commander von Hennig; the penetration of this boat into Scapa Flow. . . ." From this, it might be inferred that the *U-eighteen* managed to get into Scapa Flow, and succeeded in returning to Germany with valuable information, obtained during her reconnaissance of the British grand fleet's anchorage. Our comment is this: (a) From the accounts given by Admiral Lord Jellicoe in *The Grand Fleet;* by the late Sir Julian Corbett in *Naval Operations* (Vol.

II, pp. 14-15) and by Mr. Keble Chatterton in *The Auxiliary Patrol,* it is conclusively demonstrated that the *U-eighteen* never "penetrated into" Scapa Flow, on November 23, 1914. (b) By following in the wake of a steamer, the submarine managed to approach the boom guarding the Hoxa Entrance but she never saw the grand fleet, for the simple reason that the British battle squadrons had gone to sea on the preceding day, the 22nd. (c) While attempting her retreat, the *U-eighteen* was sighted and attacked by British patrol craft; she was so severely damaged, she foundered, the whole of her crew (with the exception of one casualty) being captured. Admiral Lord Jellicoe tells us (in *The Grand Fleet*) that the circumstances of this affair were kept most secret, and the immunity of the grand fleet is to be ascribed to this cause. The expedition of the *U-eighteen* to the Orkneys certainly was an "eventful cruise," but what did it "pave the way" to? There was only one other attempt to penetrate into Scapa Flow, and that was made during the last days of the war. In October, 1918, German naval officers made up a volunteer crew for the *U.B.-one one six,* and set out with the intention of getting into Scapa Flow and attacking the grand fleet, on the "one-last-thrust-before-we-bust" principle. This lunatic expedition ended up by *U.B.-one one six* and her crew "going up" on the outer mine-filled defenses of Scapa Flow, where, incidentally, the grand fleet was *not* based at that time. Futility, and not utility, is the term which should be applied to the excursions of *U-eighteen* and *U.B.-one one six* to the Orkneys, for both boats were destroyed by the fixed and mobile defenses. For historical purposes, the affair of *U-eighteen* must be put on record accurately, for it was among the first—if not the very first—of attempts made by submarines against a defended fleet anchorage.

Towards the head of page 631, and among a list of U-boat successes, cited by Captain Gayer we find: "On February 19, 1916, the French small cruiser *Primula,* by the *U-three five,* under Lieutenant Commander Arnauld de la Periere near Malta."

There never was any "small French cruiser" named *Primula.* There was, however, a British Fleet sweeping vessel (sloop) *Primula* of the *Flower* classes. She was torpedoed and sunk by a hostile submarine in the Mediterranean, but the official British White Paper "Navy Losses" dates her loss as March 1, 1916.

Commenting further on the list of U-boat successes, as given by Captain Gayer on pages 630-631, it is interesting to find that he claims (a) the sinking of the Italian submarine *Medusa* and (b) the destruction of the French battleship *Gaulois* as achievements gained by *German* submarines. In each case the attackers were supposed to have been submarines ceded by Germany to the Austro-Hungarian Navy. From which we deduce the illuminating rule that if (1) these "ceded" submarines sank anything, they were German, but (2) if they got themselves sunk, they were Austro-Hungarian naval losses, and not to be computed among German casualties!

Going further down the list of German submarines and their victims (page 631) we come to "On January 9, 1917, the British battleship *Corn-*

wallis by the *U.G.-three two* under Lieutenant Commander Hartwig, near Malta."

This has set us a-guessing. The Germans never built any submarines with the prefix "U.G." Is this a misprint for *U.C.-three two?* British official records show that the *Cornwallis* was sunk on January 11 (and not the 9th) while, on February 23, 1917, the *U.C.-three two* blew herself up with her own mines off Sunderland (E. English coast). Within this period of six weeks, the submarine must have made the passage from the Mediterranean to a German port; have refitted, refuelled, and reloaded with mines, before going out on her last cruise. The brevity of this period makes it doubtful if the *U.C.-three two* had any concern with the end of the British battleship. The *U.B.-three two,* so far as we can infer, served with the Flanders flotilla, and never entered the Mediterranean. So we are left wondering who really did sink the *Cornwallis.*

Should not the reference to Lieutenant Commander "Walther Hans" at the middle of p. 631, and in the last line of page 647, read "Hans Walther" or "Walther (Hans)"?

At the foot of page 632 and head of page 633 we find allusion to ". . . . the record cruise of the *U-three five* under Lieutenant Commander Valentiner, which in August (1915) accounted for twenty-two freighters, five fishing vessels and three sailing vessels in St. George's Channel and the Bristol Channel, in all about 70,000 tons."

Now, how can this be? Captain Gayer's big history of German submarine operations says that, from the 4th to the 28th August, 1915, the *U-three four* and *U-three five* were on passage from the North Sea to Cattaro in the Adriatic. The *U-three five* appears to have been taken out to the Mediterranean by Kophamel, who then turned the boat over to Arnauld de la Periere. The latter officer (as we are told on p. 630) retained the command of the *U-three five* up to March 13, 1918. Valentiner, so far as we can trace, never commanded the *U-three five.* He did, however, command the *U-three eight,* and in Captain Gayer's three-volume history, all the sinkings in the St. George's and Bristol channels are ascribed to the *U-three eight,* and not to the *U-three five.* It may be asked, "is the difference between 35 and 38 so important?" To this we reply, the notorious "Thirties"—the submarines of the "U31—41 Class" were, for the most part, stationed in the Mediterranean, and were handled by U-boat "aces." These craft were, we must confess, a thorn in our sides, and the individual record of each boat merits tracing out with accuracy.

At the head of page 633, Captain Gayer refers to the well-known "*Baralong* Affair," and is quoted by the translator as saying that Lieutenant Commander Wegener was in command of the *U-seven seven,* sunk in this action. We are quite sure Captain Gayer said nothing of the sort, in his lecture. The *U-seven seven* was still building when the duel of August 19, 1915, took place, the participants being the British submarine decoy vessel *Baralong* (or *Wyandra*) and the German submarine *U-two seven,* and not the *U-seven seven.* Chatterton's *Auxiliary Patrol* gives a full account and a track-chart of this action.

At the end of the paragraph heading p. 636, we come to a curious discrepancy between Admiral Scheer and Captain Gayer. The latter authority says that ". . . . in January (1916), the *U-seven nought* escorted the steamer *Marie* on her trip from the German Bight to East Africa." (The escort was, of course, only during the initial period of the blockade-runner's voyage, for the *U-seven nought* never arrived off the E. African coast). Admiral Scheer, on the other hand says (p. 95, *Germany's High Sea Fleet in the World War*) that "one steamer, bound for East Africa, undertook, *without any escort,* to set out on the voyage." Admiral Scheer is obviously referring here to the cruise of the S.S. *Marie.* (The italics are ours.)

Coming to that most interesting part of Captain Gayer's narration, the May-June 1916 phase, covering the abandoned bombardment of Sunderland, and the Battle of Jutland, we find, towards the foot of page 642: "On May 18 (1916), the *U-two four, U-two three, U-six three* and *U-seven nought* stood out." The inclusion of the *U-two three* in this list must be inaccurate. About ten months before the Battle of Jutland—on July 20, 1915, to be exact,—the *U-two three* had been decoyed by the British trawler *Princess Louise,* and sunk by H. M. submarine *C-two seven.* Obviously, then, the *U-two three* could have played no part in events ten months subsequent to her decease. The reference, we suggest, must be to the *U-three two:* this deduction we make from, (a) discovering the *U-three two* among Admiral Scheer's list of the U-boats, engaged in North Sea operations, just before Jutland; and (b) finding Captain Gayer (at head of page 644) suddenly alluding to the *U-three two* as being in position (on the morning of May 31, 1916) 155 miles east of the Firth of Forth.

Captain Gayer does not mention the officers in command of the U-boats engaged in the May-June 1916 operations. If such a list is required, it can be found by reference to Admiral Scheer's book. Captain Gayer details the movements of the *U-four six* and *U-six seven,* but Admiral Scheer does not include these two boats in his list—possibly, because they were not under his immediate command. It is strange that Admiral Scheer makes no reference to the movements of the three mine-laying submarines, *U-seven two, U-seven four* and *U-seven five,* which had an important mission to perform, i.e. the planting of mines off the British fleet bases. In his large history, Captain Gayer says that two boats, the *U-seven one* and *U-seven two,* were sent out to sow mines off the Firths of Moray and Forth, but both developed defects, and had to return to port (April 21, 1916), without having carried out their missions. In his lecture, he only specified the failure of one boat, the *U-seven two.* On page 642, he says it was the *U-seven* four, not the *U-seven one,* which was sent out to mine the approaches to the Firth of Forth. He makes no further reference to her movements. We can remedy the deficiency by saying that, on May 27, the *U-seven four* was caught on the surface, off Aberdeen, and sunk by the already-famous Peterhead Auxiliary (trawler) Patrol.

On page 646, third line, *"U-five seven"* is a mistake, for which, read instead, *U-seven five.* The boats of the *U-five seven, six two* class were *not* mine-layers, whereas the units of the *U-seven one, eight nought* class

most certainly were. It has long been established that the *U-seven five* laid the mines off the Orkneys, that caused the loss of the British Cruiser *Hampshire,* and the death of Field Marshal Lord Kitchener.

There are references (on p. 646, 655 and 658) to the *B-11* and *C-11* boats. If read as printed, these references might be interpreted as "B-eleven" and "C-eleven," and, on turning up lists, it would be puzzling to find that there were no such classes of German submarines. The numerals should have been printed (and should be read) as *Roman* and not as Arabic numerals, for they are "marks" indicating designs of submarines. To elucidate this:

"MARK" OR SERIES: (Roman numerals)		BOATS NUMBERED: (Arabic numerals)
"U.B.I"	comprised	U.B.1-17 class
*"U.B.II"	comprised	*U.B.18-47 class
"U.B.III"	comprised	U.B.48-249 classes
(Following were all Mine-Laying Boats):		
"U.C.I"	comprised	U.C.1-15 class
*"U.C.II"	comprised	*U.C.16-79 class
"U.C.III"	comprised	U.C.80-192 classes

* These are the types to which Captain Gayer refers.

At the head of page 655, Captain Gayer mentions the "unexplained loss" of four German submarines, in January, (1918) during passage of the Dover Straits." This statement frankly astonishes us. Mr. Keble Chatterton—an excellently informed writer—says (in his book, *The Auxiliary Patrol*) that Captain Gayer was, in the later stages of the war, co-head of the German submarine service. It is therefore amazing that an officer, occupying so high a station, should still be in the dark regarding the loss of these boats. We can tell Captain Gayer, on the strength of British official lists, that all the four submarines he mentions, *got through the Dover Straits.* It is quite true all four were sunk, but all met their ends, well to westward of the Dover Straits. We will take the four submarines specified by Captain Gayer, and demonstrate that they were never lost anywhere near Dover:

U-eight seven (Speth-Schulzberg) was rammed by H. M. sloop *Buttercup,* and destroyed by depth charges of *P-five six* in the Bristol Channel, on Christmas Day, 1917. She was not sunk in January, 1918.

U-eight four (Rohr) rammed and sunk by *P.C.-six two* in St. George's Channel, January 26, 1918:

U-nine three (Gerlach) sunk by the S.S. *Braeneil* off the Lizard (Cornwall), January 7, 1918:

U-nine five (Brinz), fate uncertain. Officially listed as "sunk to westward of the British Isles, January, 1918."

It is on page 657 that Captain Gayer springs the grand surprise on us. Dealing with German submarine programs, he says:

"Thus it came about that at the outbreak of the revolution, 440 submarines were under construction . . . . while 330 new contracts had been placed. . . . ."

An English newspaper, commenting upon the PROCEEDINGS translation of the Gayer Lecture, interprets the above passage as meaning that, in November, 1918, Germany had no less than *seven-hundred-and-seventy* submarines building or on order. Is this the impression that Captain Gayer wishes to convey? If it is, then the famous United States war programs for destroyer-building pale into insignificance before this huge effort by the German shipyards. But the suggestion that Germany had, at the end of the war, 770 submarines in hand or under contract, strikes us—to say the least—as a trifle exaggerated. And here we will state our grounds for our view.

Since 1919, a subcommittee of the Reichstag has been sitting, for the purpose of ascertaining the causes underlying the loss of the World War by Germany. Admiral von Capelle, Secretary of the German Admiralty, 1916-18, was put on the stand, to explain the breakdown of the U-boat warfare upon shipping. In his evidence, von Capelle said that, from first to last (and including all boats, both before and during the war), contracts were placed for 810 submarines. This total has been checked time and again, and every time it has been found true. If we deduct Captain Gayer's 440 boats building *plus* 330 contracted for (total 770) from Admiral von Capelle's total of 810 boats, completed, building and ordered, we reach the truly astonishing conclusion that, from August 1914 to November 1918, Germany only had 40 completed U-boats for active operations! This is manifestly absurd, because the Germans admit ("Taschenbuch for Kriegsflotten in the World War 1922" p. 315) that 178 completed submarines were destroyed.

Naval history cannot be adequately prepared—much less studied—unless there is some concrete statement describing the forces available, the casualties suffered, and the elements surviving at the conclusion of hostilities. The present writers have carefully and continuously studied the question of German submarine strength and casualties, 1914-18, from 1919 down to the present time. It is not necessary to give here in detail the elaborate forms of analysis they have used. To the best of their present knowledge, the whole tangled problem of U-boat forces in the world war can be summed up in this way:

1. Admiral von Capelle's total of 810 boats, built, building and on order, November, 1918 is demonstrated as correct.

2. Out of these 810 boats, Schwarthe's "die Technik im Weltkrieg" shows that 372 boats were completed, the German naval architect Schürer ("Schiffbau," April 23, 1919) lists three seven three submarines as having been completed, both before and during the war. Schwarthe's total appears to us to be the more correct one.

3. Of the above 372 completed submarines, 203 were "stricken from the list" during the war, having been sunk by the Allied navies, destroyed by

unknown causes, blown up or broken up by the Germans themselves, ceded to Austria-Hungary, etc. At German ports (or interned in neutral ports), 169 completed submarines survived when the Armistice was declared.

4. We have a residue of 438 boats to account for—that is, within four units of Captain Gayer's total of "440 boats under construction." How many of these boats were actually begun? So far as can be ascertained on November 11, 1918, *226* submarines were lying unfinished in German shipyards, while *212* had been contracted for, but had never been begun. Our summary then is:

On November 11, 1918

203 boats, completed and "stricken"
169 boats completed and surviving

372 boats actually completed	372
Begun, but never completed	226
Ordered, but never laid down	212
Total as declared by von Capelle	810

If Captain Gayer—for whose talents as a historian, the present writers have every respect—could elucidate, by definite statistics, the condition of German submarine programs at the end of the war, he would materially assist students of war history. In view of the above figures—the outcome of very careful analysis—we cannot accept Captain Gayer's statement that, in November, 1918, 440 submarines were building, while an additional 330 were on order. Provided always that while the lecture was undergoing lingual transmutation, the author's meaning was not misconstrued by the translator.

At the head of page 659, Captain Gayer says:

"After the Commander, submarine forces, had abandoned the passage through the Dover Straits in February, 1918, a procedure had been established, based on the experiences of Commanders Rose and Saalwachter, by which the average loss of boats did not exceed two per month." Surely there must be an error in computation? British official records show that, from March to October, 1918, German submarines losses in the North Sea and Dover Straits averaged 3.25 per month, exclusive of those due to the northern barrage.

And finally, Captain Gayer is reluctant to admit the efficiency of the northern barrage, that gigantic wall of steel and T.N.T. which was being built up across the North Sea, and in whose creation the U. S. mine force played so large a part. He will only concede that two boats, the *U-one five six* and *U.B.-one two seven* were ever destroyed in this barrage.

For the last time, we turn to official British records. We find that, in addition to the two boats nominated above, the following further craft met their doom, in that portion of the northern barrage, which was completed by the end of October, 1918.

Number	*Date of Loss* (1918)
U-nine two	September 9
U.B.-one nought four	September 19
U-one nought two	September —
U.B.-one two three	October 19

Incomplete as the northern barrage was, it put a definite stop to the careers of six U-craft in the space of about two months, let alone other submarines, which it seriously damaged, but did not completely destroy. Captain Gayer frankly says that the threat of this Barrage was "very unpleasant," and that is a notable admission to have won from him.

The present writers desire to stress the fact that they are not, in any way, actuated by animosity towards Captain Gayer, in presenting these notes. They are indebted to his writings and lecture for a mass of most useful historical data. Their interest in this particular subject—German submarine operations, 1914-18 has been so great, it has prompted the preparation of these comments. Their interest further inspires the hope that Captain Gayer's name will be again (and soon) found in the pages of these PROCEEDINGS. For there are still many problems and questions, ancillary to the late German submarine service, which still require elucidation. Only a historian of Captain Gayer's talent is competent to perform research into this particular branch of war history.

Sea Power and Pocketbooks

(See page 2231, December, 1925 PROCEEDINGS)

BROCKHOLST LIVINGSTON.—Captain Knox in treating the subject of our merchant marine touches on the use of foreign propaganda in the United States. He states that "judging from the strength of the anti-American Navy propaganda now being carried on both here and abroad, it seems a fair assumption that much (if not all) of the home opposition to the best interests of our merchantile sea power could be traced to the same source." "The importance of the matter," he states further, "would seem to make an investigation of it worth while." This idea has been broached by various members of Congress but nothing seems to come out of it. Many organs of the press, possibly with foreign prompting, belittle the plan and it is dropped. It is fair time a definite program for combating these attacks be adopted and carried out.

Captain Knox infers that the naval officer is not fulfilling his duty of informing the country as to the causes for maintaining a navy. There have been repeated statements that the navy men are not doing their share to indoctrinate the public. Personally, this writer does not agree with many of these thrusts but there does appear to be a lack of earnestness where these men are concerned. Admiral W. L. Rodgers' remark in the February, 1926, PROCEEDINGS that: "The increase in paper work which is growing so fast in the past few years is to my mind an evidence, among others, of a growing inefficiency and lack of discipline in the Navy," does not seem to ring true

to the past history of the Navy. There is something wrong somewhere. Perpetual talk of disarmament with its attendant reduction of personnel may be the cause of a lowered morale. If so, it is but another score to be repaid the enemies of the armed services of the nation.

In dealing with the matter of foreign influence, Captain Knox makes mention of the naval editors of two American newspapers, one a prominent New York publication. He states that inquiry has shown that these men were born in the country which their articles had defended and, as far as is known, remain citizens of that country. Surely from among the citizens of America there can be found enough naval writers to undertake the limited work required by the press. Possibly the source of the foreign publicity requires that our leading newspapers avail themselves of the services of naval editors of the nationality advised. Would it not be the proper course for the Navy Department to deny naval news to the papers employing foreign editors? Certainly if the danger from their employment is so great, and no one can deny that it is, the nation, through its servants in the government, may take this precaution.

While on this subject it would seem wise to touch upon the Institute's recent action of conferring the gold medal on Hector C. Bywater, a British writer, for his Prize Essay. The present writer feels at liberty to discuss this matter since he is not among those whose papers were not accepted, not having submitted an essay for the competition. Among the many purposes of the Naval Institute is that of encouraging writers on naval topics. Presumably we understand these writers to be American but we now find the most coveted award given by the Institute, presented to a writer of foreign nationality. There is nothing in the Institute's action which may be looked upon as unfair for the award was made without knowledge of the name of the writer. There remains only the duty of so changing the rules for the annual competition that no further cases of this kind may be possible. American writers only must be offered the chance to win. If, in America, we can not produce one worthy of the gold metal, the sooner we train one the better it will be for the naval service and, incidently, the nation.

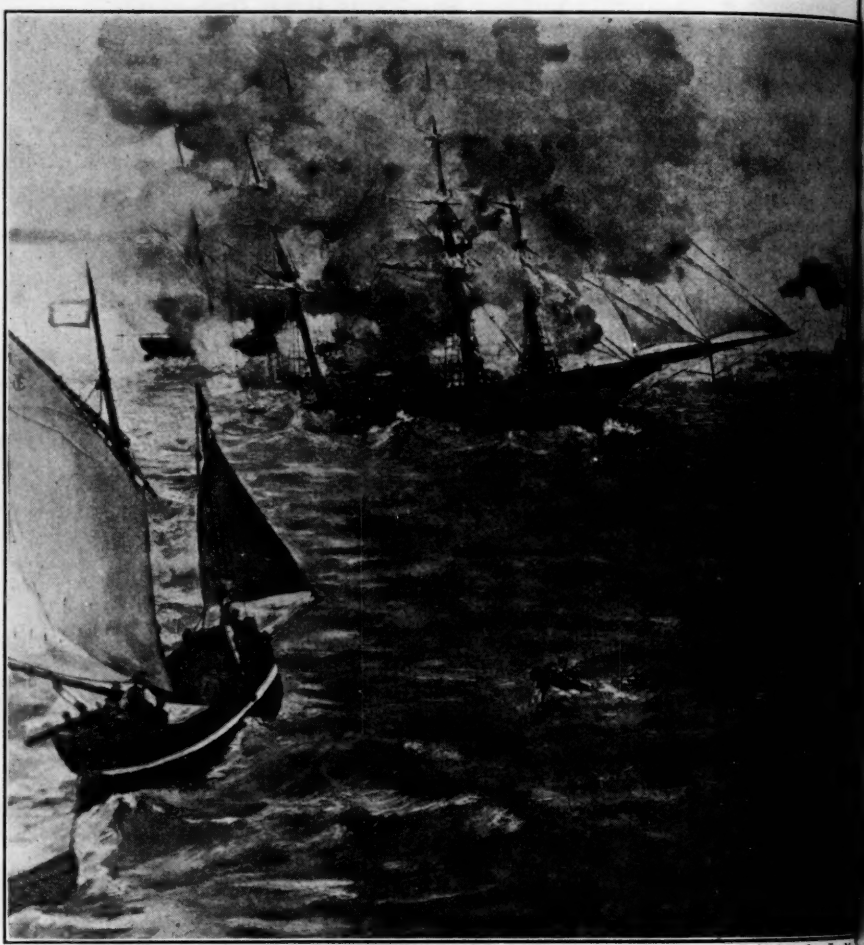
Mr. Bywater is a brilliant writer but then, England has many who excel along the same lines. America does not want these men to dictate our naval policy. Their views are many times too radical to suit our tastes, as Mr. Bywater's "Post-Treaty Naval Design" showed. Commander E. G. Allen writing of this article in the PROCEEDINGS for February states "he can not see the articles turned loose on the young thought as evidencing post treaty capital ship design without sounding a warning about the neighbor's green apples being bad for small boys." Commander Allen's warning need only be repeated here.

To bring about the improvement in publicity which Captain Knox, from his intimate knowledge, advises, there is needed the closest cooperation possible. The Navy on its part must show the utmost interest in encouraging our civilian writers on naval subjects. The reorganization of the Naval Reserve makes possible the commissioning of many of these writers as Special Service officers for duty in the Office of Naval Intelligence during

war-time. Here their services would be valuable for combating the propaganda which threatens to impair the integrity of our naval service. In war we may look for an increased effort to do damage by this means. Undertaking its overthrow in peace by training a body of our own writers seems to offer the surest means of avoiding it in war.

EDITOR'S NOTE:—The Naval Institute has always followed the policy that any writer, regardless of nationality, was free to compete in its annual Prize Essay Contest; and this too regardless of whether or not the competitor was a member or associate member of the Naval Institute. The annual Prize Essay Contest was started in 1879 and the prize was won in 1892 by a Britisher, William Laird Clowes, who was not even an associate member, the title of his essay was "Torpedo Boats: Their Organization and Conduct." Needless to say, Mr. Livingston is correct in his statement that "the award was made without knowledge of the name of the writer."

The Naval Institute still believes that the greatest good will result by placing no limitations whatsoever upon the nationalities of those competing in its annual prize Essay Contest.



(Reproduction of Painting by L. M

(See page 1681 this issue).

BATTLE BETWEEN THE "KEARSARGE" AND "ALABAMA"

The above is a reproduction of the photograph of a painting by L. Manet, which i property of the Cherbourg Chamber of Commerce.

Foreground: French pilot boat from Cherbourg, belonging to Mr. Gosselin, who some of the survivors.

Center: *Alabama* and *Kearsarge* engaged in battle. The *Alabama* sinking.

Rear: The British yacht which rescued Captain Semmes with thirteen officers and tw six sailors.

PROFESSIONAL NOTES

PREPARED BY

LIEUTENANT COMMANDER W. G. GREENMAN, U. S. NAVY

FROM JUNE 3 TO JULY 3

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UNITED STATES

Vessels Under Construction, U. S. Navy—Progress as of May 31, 1926

Type Number and Name	Contractor	% of Completion		Contract date of Completion	Probable date of Completion
		June 1, 1926 On Total Ship	May 1, 1926 On Total Ship		
	Airplane Carriers				
Lexington	Beth. S.B. Cpn. (Fore River)	80.8 79.3	78.7 76.9		4/1/27
Saratoga	New York S.B. Corp.	85.7 85.4	83.8 83.4		12/1/26
	Auxiliaries				
Holland	Puget Sound Navy Yard	99.3 99.2	96. 95.8		6/1/26
	Fleet Submarines				
V-3(SF6)	Portsmouth Navy Yard	Commission 5/22/26			
V-4(SM1)	Portsmouth Navy Yard	42.1 39.8	33. 31.7		10/1/27
V-5(SC1)	Portsmouth Navy Yard	Begun June 1, 1926			12/1/28
V-6(SC2)	Mare Island Navy Yard	Begun June 1, 1926			3/1/29
	River Gunboats				
PG43	Kiangnan Dock & Eng. Wks.	7. ..	3.3 ..		3/1/27
PG44	Kiangnan Dock & Eng. Wks.	6.7 ..	2.8 ..		4/1/27
PG45	Kiangnan Dock & Eng. Wks.	4. ..	2.5 ..		12/1/27
PG46	Kiangnan Dock & Eng. Wks.	3.3 ..	2.4 ..		1/1/28
PG47	Kiangnan Dock & Eng. Wks.	4.2 ..	2.8 ..		8/1/27
PG48	Kiangnan Dock & Eng. Wks.	3.5 ..	2.5 ..		9/1/27

Authorized but not under construction.

Pensacola (CL24)—Preliminary work started but formal authorization awaiting action on bids for *Salt Lake City* and machinery for both vessels.

Salt Lake City (CL24)—Bids opened April 1, 1926, but contract not yet placed.

Light cruisers CL26 to 28—Funds appropriated to start construction in fiscal year 1927.

Authorized by Act of August 29, 1916, but no funds for construction appropriated

12 Destroyers Nos. 348 to 359 inclusive.
1 Transport No. 2.
3 Fleet Submarines Nos. 169 to 171 inclusive.
1 Neff Submarine No. 108.

Authorized by Act of December 18, 1924, but no funds for construction appropriated.

3 Light Cruisers Nos. 29 to 31 inclusive.

GREAT BRITAIN

The Geneva Conference

Naval and Military Record, 9 June, 1926.—We are told that it is a little "premature" as yet to try and assess the results of the debates of the preparatory conference on the limitation of armaments, which began its session at Geneva on May 18 last. This noncommittal comment pretty well characterizes the general indefiniteness of the proceedings. Perhaps it is not too much to say that the one really clear factor has been the

extreme difficulty of arriving at anything like common agreement upon the elementary conditions which must be necessarily settled before details can be reached. This trouble manifested itself right away. At the first meeting it was proposed that M. Paul-Boncour, the French delegate, should take the chair. M. Paul-Boncour promptly replied that he would have so much to say which he anticipated might prove controversial in purport that he desired to retain perfect freedom of action. It was a rather unfortunate coincidence that the conference had been timed for what proved a very inopportune juncture. The repercussion of the general strike did not find the public mind in this country very responsive to pacific idealism. The arbitrary rejection by the Russian Soviet of the misplaced courtesy under which it was invited to participate was scarcely an encouraging feature. The still-recent memory of Mr. Houghton's report to President Coolidge upon the state of Europe generally gave rather a cynical touch to the presence of the United States representatives.

But, curiously enough, the principal line of cleavage lay between Great Britain and France. The Locarno Pact seemed to fade into remote intangibility in face of the principles laid down by M. Paul-Boncour. The whole-hearted disarmament enthusiasm of Viscount Cecil was chilled by the dogma of the French expert. He was for carrying things beyond the point of practicable possibility, with the result that there arose an uneasy suspicion as to whether he did not really mean to render the whole idea impossible. As an academic debate the conference proved extremely interesting. As a preparatory measure to clearing the ground for a reduction of armaments in the present, and a progressive limitation of armaments in the future, it all amounted to little more than one prolonged and rather confused negation. All the courtesy, affability, and explanations of misunderstanding left untouched the fundamental points of difference.

The "Adventure"

Naval and Military Record.—That the construction of the minelayer *Adventure* is being proceeded with on leisurely lines is evident from the fact that she was laid down as long ago as November, 1922. Probably this is largely due to the vessel embodying so many experimental features in her design that various modifications of detail are being introduced. Her main engines of 40,000 horse-power are estimated to give her a speed of 27.75 knots on full-power trial on her normal displacement load of 6,740 tons.

One thing seems pretty clear—the *Adventure* is designed to trust to her heels should she be attacked. Her armament consists only of four 4.7-in. and four 3-pdr. guns. It is reasonably safe to assume that no enemy ship with any knowledge of the real character of the *Adventure* would care to chase her, since she might be counted upon to drop mines as she went. Whether a surface cruiser is the best type of vessel for mine laying is a debatable point. The Germans did most of their minesowing with submarines, and both the American and the Japanese Navies have adopted the specially-designed submarine for this purpose. Our own Admiralty, with more complete first-hand information upon the whole subject than any other power could acquire, decided that the fast surface ship is better suited to the rôle. She can carry many times the number of mines, is considerably faster than any submarine on the surface, and her people can always see exactly what they are about.

Size of Destroyers

Naval and Military Record.—The two destroyers launched in January last for the British Navy—the first to be laid down since the Armistice—

are not twin ships as is generally supposed, the *Amazon* displacing 1,330 tons and the *Ambuscade* 1,210 tons. Both, however, are engined for 37 knots, the highest speed yet attempted in any naval craft. It is owing to this high power, coupled with the demand for an equivalent fuel endurance, that the new boats show an advance in tonnage upon the original plan, which arrived at a reduction of size upon the "W" group. These latter destroyers range between 1,275 and 1,350 tons, have a length of 300 feet, and an average speed of 34 knots. They are very fine, efficient boats, with excellent seaworthy qualities. But there is, undoubtedly, a growing feeling in favor of smaller destroyers, in as far as reduction can be reconciled with the essential qualities of speed and radius of action, and rumor has it that the new craft to be built under the replacement program will be of about 1,000 tons displacement.

It must be admitted that a hull 300 feet long offers a big target to the concentrated fire which a destroyer is likely to draw, and has a turning circle so large as to be inimical to that extreme mobility which is essential to her tactics. On the other hand, this size gives her a great advantage in fuel endurance, which is all-important when operating with a fleet. Lord Jellicoe in his book *The Grand Fleet* makes frequent reference to the necessity for conserving the fuel of his destroyers, especially during the Battle of Jutland, where he was troubled by the fear that some of them might be left with scarcely sufficient oil to carry them home again. The boats in his flotillas ranged between 850 and 1,000 tons, averaged about 270 feet long, stored between 250 and 300 tons of oil fuel, and had an average speed of 34 knots.

Status of Naval Engineers

Responsibility Which Is Not Recognized

Naval and Military Record.—What is meant by military status? Put briefly, it is the right to command men in military operations, says *Engineering*. What the naval engineers are fighting for is the right to command their own staff. Though they have to command their men in reality, nominally their right to do so is denied. Consequently these officers have all the work of efficient organizing and handling a vast and most vital department of the navy, but are refused the recognition which should accompany such responsibilities.

The anomaly thus obtains that an engineer officer is in theory subjected to the orders of even the lowest grade deck officers—such as the master-at-arms and the warrant telegraphist. By Fleet Order No. 3241 issued in November, 1925, no matter how complicated the business—no matter how high the qualities of intelligence and judgment required, the engineer officer, in undertaking any naval work either ashore or afloat, is militarily inferior to deck warrant officers. Yet Mr. Bridgeman states that there was nothing in that order derogatory to the position of engineer officers!

The Right to Command

Previous to the issue of this order, engineer officers entered since the adoption of the Selborne scheme in 1902 held the right to command their own men and to sit on courts-martial and were classed as military and executive. They still hold commissions to this effect, but the powers contained therein have been destroyed by the Admiralty without first obtaining legal sanction. It is the first time in the history of the fighting services that a body of officers has been condemned to such wholesale degradation. This action of the Admiralty cannot be justified on the grounds of fitness or expediency. As stated in *The Times* leading article of December 17, "it is morally indefensible." It inflicts a grave injustice without cause on a body of loyal officers, and must create disaffection and consequent lack of efficiency throughout a great branch of the naval service.

Modern warships are floating tanks of scientific machinery, yet the small amount of engineering training previously given to deck officers has recently been reduced to practically the vanishing point.

ONE-THIRD OF PERSONNEL

The engineering department forms a considerable portion of the total complement of the ship. Its officers and men comprise one-third of the combined numbers of deck and engineer personnel. The engineer officer with his equipment and personnel is responsible for getting the ship into position for action and maintaining her there at all costs. Contrary to the views and practice of the United States and Japan and of Admiralty policy since 1902, the present Board of Admiralty wishes to persuade the country that the maintenance and operation of the ship's machinery and the direction and training of the engineering personnel are not military duties.

On the contrary, in war time engineer officers have need to draw on all the qualities of leadership and skill to maintain the machinery and personnel at tip-top efficiency often thousands of miles from a base (the next war will possibly be in the Pacific), to steam the ship on the high seas, keep her speed in action, make temporary repairs to damaged hulls and machinery, keep the ship afloat when holed and bring the lamed ships back to port without sinking. The power machinery is the backbone of the ship. Failure in this basic function paralyses all the ship's action.

The Navy Estimates

Journal of the Royal United Service Institution.—The statement of the First Lord of the Admiralty explanatory of the navy estimates for 1926-27, was issued February 27, some days in advance of the estimates themselves. Mr. Bridgeman stated that the net total is £58,100,000, a reduction of £2,400,100 on the estimates for 1925-26, notwithstanding that the provision for new construction is increased from £7,235,737 to £9,083,693. The reduction in spite of this and other upward tendencies is due to the important decisions taken by the Admiralty in the last nine months with a view of economy. Economies of upwards of £5,000,000 have been rendered possible by the adoption of a settled program of new construction over a period of years, and by the favorable aspect of the political horizon. But for this, the First Lord would have been obliged to ask Parliament for a net total of some £63,000,000.

NOTES OF NAVY PROGRESS.

A series of "Notes on Matters of General Interest" opens with a review of the changes in fleet distribution made from motives of economy, and already announced in the *Journal.* Cooperation with the Dominions and India; the return of the Rhine flotilla; exchanges of visits between the fishery patrol and fishery protection services of other nations; additional protection of British interests in China; prevention of slave traffic in the Red Sea; and the cruise of H.M.S. *Repulse* with the Prince of Wales are other matters referred to. In regard to fleet training, the First Lord says: "In spite of the reductions which it has been necessary to make in the numerical strength of the principal fleets, mainly among the smaller vessels, and also in spite of increased economy in the use of fuel, every effort has been made to continue the tactical training of the fleet in as realistic a manner as numbers allow, and to keep pace with modifications and improvements in weapons and design." The need for economy will prohibit any mobilization and exercise of the reserve fleet during 1926.

FLEET PERSONNEL

The personnel of the fleet amounts to 102,675, the same as last year. Owing to the large economies made, the numbers now included in vote

"A" will provide crews for all new construction up to and including the 1925 program. It is proposed to recommence the entry of a few short-service seamen this year. Lack of recruits for the medical branch of the fighting services has led to an inter-departmental committee, under the presidency of Sir Warren Fisher, G.C.B., being set up to consider rates of pay and matters ancillary thereto. Promotion from the lower deck has now been resumed in all branches. Six promotions to boatswain were made on January 1, 1926. A simpler scheme of efficiency assessments, based solely upon efficiency in a man's substantive rating, will come into force on May 31, next. In consequence of the difficulty in finding accommodation afloat for seamen-class boys and young ordinary seamen, arrangements have been made for about 500 of these to be accommodated at Port Edgar, where they are trained for able seamen in the barracks and vessels of the destroyer flotilla stationed at that port.

New Construction

On this subject, the First Lord states that the estimates provide for carrying on the program laid before Parliament last July. It was originally intended that the floating dock for Singapore, included in this program, should be provided by the reconstruction of an ex-German dock, but experience has shown this to be impracticable, and a new dock is accordingly being ordered. The 1926 program includes provision for commencing work on the following ships:—2 "A" class cruisers, 1 "B" class cruiser, 6 "O" class submarines, 1 submarine depot ship, 1 repair ship, and 4 motor launches. One "A" class cruiser and one submarine will be built in the dockyards, the construction of the remaining vessels being put out to contract. The minelayer *Adventure*, submarines *O.1* and *L.26*, and the destroyers *Amazon* and *Ambuscade* are to be completed during the financial year 1926-27. One of the *King George V* class of battleship, to be taken in hand for scrapping at the end of 1926, will be converted into a target ship to replace the *Agamemnon*. On April 3, it was announced that the vessel selected for this purpose would be the *Centurion*, the cruiser *Weymouth* relieving her as flagship of the vice admiral commanding reserve fleet.

Miscellaneous Notes

H. M. S. "Centurion" to Become Target Ship

The Admiralty have given orders for the battleship *Centurion*, now serving as flagship of the vice admiral commanding reserve fleet, to be paid off for conversion at Chatham into a target ship for the Atlantic fleet in place of the battleship *Agamemnon*. The *Centurion* will shortly become due for scrapping under the Washington naval agreement.

The *Weymouth*, crusier, left Plymouth April 1 for Portsmouth to replace the *Centurion* as flagship of the vice admiral commanding reserve fleet.

Battleship Refits

Since the numerical strength of the battle fleet is restricted by the Washington treaty, it is natural that the Admiralty would desire to maintain such ships as we have in the highest possible state of efficiency. To this end a fairly large program of reconstruction is being carried out. In recent years the five ships of the *Royal Sovereign* class have been fitted with anti-torpedo bulges, while important additions have been made to the armor and underwater protection of the battle cruisers *Repulse* and *Renown*. A start has now been made with the work of modernizing the five *Queen Elizabeth* battleships, the *Warspite* being the first to undergo this process. She is to be commissioned at Portsmouth next Tuesday to relieve the nameship of the class as flagship of Admiral Sir Roger Keyes in the Mediterranean. The *Warspite's* appearance has been completely

altered by the reconstruction. The most striking change is in the position of the funnels, which are now trunked together, the base of the first funnel having been curved backward and cased in with that of the second. By means of this arrangement the navigating position and the fire-control stations in the forward part of the ship are kept free of funnel smoke. It is understood that the other four ships of the class will be treated in the same way, and will also receive bulge protection. It is apparently not intended that the five oldest units of the battle fleet—the four *Iron Dukes* and the *Tiger*—shall undergo extensive refit, as these vessels are due to be scrapped in 1934-35. The *Iron Dukes* are now to be formed into a training squadron for boys and will be attached to the Atlantic Fleet.

Destroyer Tests

Presumably it is the intention of the Admiralty thoroughly to test the new destroyers *Amazon* and *Ambuscade* before any more ships of this type are ordered. If this surmise is correct, the decision is interesting in view of the fact that these boats are designed according to the ideas of their builders, Messrs. J. I. Thornycroft and Yarrow, respectively.

The First Lord's memorandum on the navy estimates states that these ships will be finished during the coming financial year, so that the nine destroyers which are to be built under next year's estimates need not be laid down until the *Amazon* and *Ambuscade* have been thoroughly tried and the best points of their design decided upon.

It was the Admiralty's policy in the nineties and the early days of the twentieth century to permit the private shipbuilders to work their own ideas into the designs of their destroyers and to make a careful note of the best feature of each against the time when the department was to undertake its own designs.

New Cruiser Contracts

The allocation of names to the contract-built cruisers of the 1925-26 program is now officially announced, and the laying of the keels of these ships may therefore be expected very shortly. Messrs. Beardmore & Co. (Ltd.), Dalmuir, are to build the *Shropshire* and Messrs. Hawthorn, Leslie & Co. (Ltd.), Hebburn-on-Tyne, the *Sussex*. The two dockyard ships in the same program, the *London*, at Portsmouth, and the *Devonshire*, at Devonport, have already been begun on the slips vacated by the *Suffolk* and *Cornwall*, respectively. but the financial provision for the coming year is larger in their case. On the *London* £793,785 is to be spent by March 31, 1927, and on the *Devonshire* £790,888; but the sums allocated to the *Shropshire* and *Sussex* are £560,071 and £556,458, respectively. With the putting in hand of these four ships the total number of British cruisers under construction is eleven, the others, including the Australian ships *Australia* and *Camberra* and the five authorized in the MacDonald program of 1924. The last named are now all afloat, the last of these to take the water being the *Berwick*, which was launched at the works of the Fairfield Shipbuilding Co. on March 30 by Lady Stirling-Maxwell.

H. M. S. *Enterprise*, commissioned at Devonport April 7 as an independent command for service in the fourth cruiser squadron on the East Indies station. This is the last of the many war-time crusiers laid down in June, 1918, at the Clydebank works of Messrs. John Brown & Co. (Ltd.) and transferred after her launch on December 23, 1919, to Devonport Dockyard, where her machinery has been installed. The total estimated cost of the ship, including guns, is £1,759,975. She will relieve the *Cairo*, Captain E. O. Cochrane, at present at Colombo, which will refit at Devonport in July and then go to the North American station to relieve the *Curlew*.

Engines for New Dockyard Cruisers

It is announced in fleet orders that the two new cruisers of the 1925-26 program to be built in the Royal Dockyards will be engined as follows:

H. M. S. *London*, Portsmouth dockyard, by the Fairfield Shipbuilding & Engineering Co. (Ltd.), Govan.

H. M. S. *Devonshire*, Devonport dockyard, by Messrs. Vickers (Ltd.), Barrow-in-Furness.

Trials of "L-27" Completed

The new submarine *L-27*, which has been completed at Sheerness Dockyard and carried out her acceptance trials last month, has joined the fifth flotilla at Portsmouth as tender to the *Dolphin*. The submarine, like *L-26*, completing at Portsmouth, was laid down by Messrs. Vickers (Ltd.) in the last year of the war.

The large seagoing submarine *X-1* has also joined the fifth flotilla.

Long Cruise of "X-1"

Submarine *X-1*, the largest vessel of her type in the world, a submersible cruiser with a surface displacement of 3,600 tons, has left Portsmouth for Gibraltar and will probably extend her cruise halfway around the world.

This trip is no doubt the first stage of an experimental voyage similar to that carried out to Singapore and back by submarine *K-26* in 1924 and will extend to about 20,000 miles. First commanded by Commander (now Captain) R. H. T. Raikes, and since January of last year by Commander P. E. Phillips, submarine *X-1* has been carrying out trials and experimental runs in home waters for over two years. She had a special series of trials a year ago, following her official trial just before Christmas, 1924, and last September and October went to Portsmouth for gunnery tests by the staff of the Whale Island Gunnery School and other trials. So recently as February she made full-power runs in the North Sea in the presence of Admiralty officials, and followed these with speed tests over the measured mile in the Thames Estuary.

The *X-1* has been assigned to the fifth flotilla. She is the first underwater craft to have a ship's canteen.

Progress of Salvage of German Ships

With the raising of the German destroyer *B-109* at Scapa Flow, the twenty-third boat to be recovered, there remain only two more destroyers to be brought to the surface. A start has now been made by Messrs. Cox & Danks, who are conducting the operations, on the salvage of the battleship *Hindenburg*.

Seaman and "A. B." Ratings

The experiment, if such it may be termed, under which an ordinary seaman in the Royal Navy could be rated "A. B." after six months' service in the former grade, has now been disallowed. There may be exceptional circumstances in which such a course might be justified, as in the case of a youth who had joined the service from the fishing industry, with a general knowledge of the sea imbued in him from his earliest consciousness and a seafaring instinct due to long heredity. But these instances are merely the exception which prove the rule. Experience has shown that six months as an ordinary seaman is a totally inadequate period in which to produce an able seaman in the present-day definition of the term. And so in future the period is to be eighteen months, although in exceptional cases a captain may rate an ordinary seaman "A. B." after fifteen months if he is satisfied that his qualifications justify the advancement. Time spent in training classes is taken into account, and it is laid down that an ordinary seaman must have served at least nine months in a seagoing ship to be eligible for the higher rating.

Ships Gunnery and Torpedo Improvement Funds

Grants to gunnery improvement funds are payable to His Majesty's ships in full commission or in commission with reduced crews. Grants to torpedo-improvement funds are payable to His Majesty's ships in full commission and to seagoing vessels with reduced or special complements which carry their torpedoes on board. The grants are payable annually in advance, in accordance with the scale shown below. His Majesty's ships in reserve are not eligible for these grants. Ships newly commissioned may draw on commissioning the proportionate amount due for the year in which commissioned. The moneys may be expended upon such objects as entrance fees for competitions and minor fittings and devices not included in the usual equipment but which tend to promote gunnery efficiency. It is, however, specially pointed out that no portion of these grants is to be expended in prize money or as an emolument for any person in the navy.

Gunnery improvements funds

	Per annum each £	s.
Battleships and battle cruisers	10	0
Cruisers of 8,000 tons and over and large aircraft carriers	8	0
Cruisers under 8,000 tons, large monitors, destroyers, and submarine depot ships	5	0
Small monitors, sloops, gunboats, flotilla leader destroyers	4	0
Patrol boats, submarines, and other independent commands not included in above	2	0
Yachts, trawlers, drifters, and tenders not provided for in above	0	10
Battleships, battle cruisers, cruisers of 8,000 tons and above, and aircraft carriers of 17,000 tons and above	20	0
Cruisers under 8,000 tons and aircraft carriers under 17,000 tons	10	0
Flotilla leaders and destroyers	3	0
Submarines	4	0
Coastal motor boats fitted with torpedo armament	0	10

India's Defense Problem

Air mastery is considered to be a vital factor to the successful defense of India. At least this seems to be the general trend of opinion among London officials as well as officials in India, as indicated in recent press reports. They have carefully measured the striking force which an opposing power might use in its attack and have drawn a very striking comparison between India's war force and the forces of border countries.

In a recent press report it was pointed out that the Russian air force in Turkestan had vastly improved in quality and had increased in quantity during the past year; that the Afghan air force, which is chiefly manned and machined by Russians, now has twelve serviceable machines and that it is proposed to increase the number of fighting machines to thirty.

Against India's lack of anti aircraft guns and anti gas measures Russia is reported to be able to throw a fairly well equipped force. India's six airplanes are reported to be much slower than the Russian airplanes at Kabul and otherwise inferior in the matter of latest improvements. It has been suggested there is urgent need for additional squadrons in India equipped with modern fighting equipment and considerable agitation is going on to secure this needed force.

It has been emphasized by the *Journal* of the United Service Institution of India that air supremacy is of the utmost importance to the successful conclusion of future wars conducted against India, and it points out, in this connection, that—

(1) At the outset, possibly before the formal declaration of war, both sides will conduct an intensive bombing campaign, with the object of de-

stroying their opponent's nerve centers, alarming the civil population, and hampering all military preparations.

(2) Coincidentally with these attacks there will be an attempt to attain air superiority by the destruction of the enemy's aircraft and air bases.

(3) Following this grand bombardment, the war will begin more or less normally on land and sea, it being assumed that it will be highly dangerous to start concentrations or overseas movements of large forces till the first phase of this intensive bombardment has expended itself. The air staff goes one step farther and assert that it is now within the realms of possibility that the results of this initial bombardment may be so far reaching as to end the war without recourse to the more normal methods.

The older services are, quite naturally, somewhat skeptical of this latter possibility. Yet, considered apart from wholly natural service prejudice, it is undeniable that this development may come.

FRANCE

Reorganization of the High Command of the French Naval Forces

Journal of the Royal United Service Institution, May, 1926.—The following reorganized system of high command of the French Naval Forces was brought into being in January of this year (1926):—

Commanders-in-Chief Afloat

The Vice Admiral, Chief of the Naval Staff in peace time, assumes supreme command of the navy on the outbreak of war, with the title of Commander-in-Chief of French Naval Forces, exercising this command from on shore.

His duties as Chief of the Naval Staff are then undertaken by a Vice Admiral, nominated in time of peace, who assumes the title of Deputy Chief of the Naval Staff (*Major-Générale de la Marine*).

Two Vice Admirals, in time of peace, are appointed as Inspectors General of the Naval Forces of the North and of the Mediterranean respectively. On the outbreak of war they assume command of these forces with the titles of Commander-in-Chief of the naval forces of the North (the North Sea, Channel, and Atlantic) and Commander-in-Chief of the naval forces of the Mediterranean. They may carry out their duties from on shore or afloat, but do not displace the existing commanders-in-chief afloat, who still retain the executive commands. These naval forces include high sea forces, patrol forces, and the fixed and mobile land, air, and floating defenses in their areas. It is to be noted that operations taking place in the Atlantic may not always come within the first-named area, the limits of which will be fixed according to circumstances by the Commander-in-Chief, French Naval Forces.

In times of peace these two Vice Admirals form part of the Superior Council of the navy; as Inspectors General they are without executive authority, each Commander-in-Chief and *Préfet Maritime* being separately responsible to the Minister of Marine for the forces under his command.

In war, the patrol forces will be commanded, in each of the following seas, viz., Mediterranean, Channel, North Sea, and Atlantic, by a flag officer appointed in time of peace. On mobilization, these officers assume the title of Senior Officer in Command of Patrol Forces. (*Commandant Supérieur des Forces de Patrouilles*), and are responsible to the commander-in-chief of their maritime areas.

Admirals Superintendent

Consequent on the introduction of a Deputy Chief of the Naval Staff (*Major Général de la Marine*) the title of Admiral Superintendent (hitherto *Major Général de la Marine*, Cherbourg, Brest, etc.) has been changed

to *Major Général du* (1st, 2nd, etc.) *Arrondissement;* their duties remaining unchanged.

Préfets Maritimes

For military and administrative purposes the coast is divided into six naval arrondissements.

A Vice Admiral is *Préfet Maritime* of each of the following arrondissements:—1st, 2nd, 5th and 6th.

A Rear Admiral is *Préfet Maritime* of the 3rd and 4th respectively.

In peace time a *Préfet Marine* of Vice Admiral's rank holds the title of *Commander-in-Chief* and *Préfet Maritime.*

Duties of Préfet Maritimes. Responsible for the defense of the coast, for anti-aircraft defenses, for all technical and administrative services, including the recruiting of personnel. He has under his orders—

(*a*) The naval arsenal of the port.
(*b*) The naval bases (administrative purposes only).
(*c*) Vessels attached to the coast defense.
(*d*) Vessels in reserve or doing trials.

To whom responsible. In peace time, the Vice Admirals are directly responsible to the Minister of Marine.

The Rear Admirals (3rd and 4th arrondissements) to the Vice Admiral (2nd arrondissement) for all matters concerning coast defense, and to the Minister of Marine for all other matters.

In war time, the Vice Admirals to the Minister of Marine for all matters of a technical or administrative nature which do not concern operations.

In all that concerns operations, to the Vice Admiral Commander-in-Chief of the naval forces of his particular theater of operations.

The Rear Admirals (3rd and 4th arrondissements) as in peace time. In peace time the *Préfets Maritimes* reside in the principal naval port of their respective arrondissements; in time of war they may transfer their headquarters according to circumstances.

Naval Sectors

For military purposes the coast of each arrondissement is divided into naval sectors, commanded, as a general rule, by flag officers or senior naval officers. Supplementary sectors may be formed in time of war.

The commands of these sectors are directly under the *Préfet Maritime* of the arrondissement; the Rear Admirals, *Préfets Maritimes* of the 3rd and 4th arrondissements, are also commandants of the naval sectors constituted in their respective arrondissements.

Naval Bases

The naval bases in each arrondissement, with the exception of the main naval base, are under the command of flag officers or senior naval officers, having the title "in Command of Naval Forces at . . . ." (*Commandant la Marine à . . .*). These officers, as a general rule, are in command of the naval sectors in which their bases are situated. They are directly responsible to their *Préfets Maritimes.*

Superior Council of the Navy

Consequent on the reorganization of the high command, the post of Inspector General of the Atlantic Coast has been abolished, as being superfluous.

The Vice Admiral recently holding this appointment was also in command of the Staff and War Colleges, and he is now free to devote himself entirely to these colleges.

The superior council of the Navy is a purely advisory body, specially charged with furnishing considered opinions on questions relating to naval warfare and coast defense. It is composed of the following members:

(1) The Minister of Marine (President).
(2) The Chief of the Naval Staff (Vice President).
(3, 4) The two Vice Admirals, Inspectors General of the Naval Forces of the North and of the Mediterranean.
(5) The Vice Admiral Commanding the Mediterranean Squadron.
(6) The Vice Admiral Commanding the Naval Staff and War Colleges.
(7) One Vice Admiral serving in Paris, selected annually by the Minister of Marine (this year, the officer selected is Vice Admiral Varney, president of the technical committee).

The Minister of Marine may nominate other flag officers as additional members of the council, at his discretion.

The two assistant chiefs of the naval staff are consultants, a senior naval officer acts as secretary, and one of the flag officers acts as reporter of the council.

The Chief of the General Staff of the Army and another member of *le Conseil Supérior de la Guerre* are also coopted on the council in a consultative capacity.

The council deals with all questions concerning—

(1) General organization of the Navy.
(2) Procedure for recruiting, training, and utilizing men and officers.
(3) General organization of coast defense.
(4) Naval construction program.
(5) General characteristics of the various units to be laid down, including seaplanes and airships.
(6) Fighting tactics of the naval forces.
(7) Creation, extension or suppression of naval arsenals, *points d'appui* of the fleet and coast defense works.

The superior council is summoned by the Minister of Marine as often as is necessary for the examination of matters submitted to him. It may also be convened by the president of the republic, in which case the president of the council (Ministerial) is always invited to attend.

The proceedings are secret and a permanent record is kept.

The action to be taken as a result of the report of the superior council rests with the Minister of Marine.

French Naval Notes

Naval and Military Record, 2-16 June, 1926.—Minister Leygues, who is certainly of the seven post-war Marine Ministers the one who has devoted the greatest amount of personal attention to naval welfare and efficiency, is just now inspecting *en detail ports militaires* and all naval establishments, and bringing invaluable governmental encouragement to all those who are striving, in capacities however humble, for the greatness of *la vieille Marine Française*.

The simultaneous commissioning of thirty new light vessels has shown the crying need of more officers and seamen. The École Navale is this year to receive eighty-five pupil-officers, as against seventy on an average for previous years. No fewer than 333 candidates have been mustered, all university graduates (bacheliers) for the competitive entry examinations, which points to the navy rising in public favor. It has been found out that the knowledge up to the present required from naval candidates is far too scientific and covers too wide a field, and that it was perfectly absurd to exclude history and geography from examination subjects. Not clever summaking but love of the sea and of country, together with the highly-developed fighting instinct, make worthy *officiers de vaisseau*.

The 8,000-ton croiseur léger *Duguay-Trouin*, laid down at Brest so far back as August, 1922, and launched in August, 1923, has at last commenced

her series of official trials. Her eight boilers and Parsons-geared turbines, that are the most powerful of their type afloat, are being relied upon to work satisfactorily. On May 5, in the course of a three-hours' run at 90,000 horsepower, she did 33.5 knots, which has been considered good, her condensers proving equal to the strain, and her behavior in the rough sea being as good as could be desired. The American *Omahas,* of similar displacement and 90,000 horsepower, that are shorter (167 meters against 181) appear to have done just as well with the same power. The British *Emeralds* of 7,800 tons, when steaming at full power (80,000 horsepower), attained 33.5 knots. This means that up to the present the *Duguay-Trouin's* performances have nothing very startling. On the other hand, she is expected to develop over 111,000 horsepower at full power. On trial, her eight boilers, that offer 1,125 square meters of heating surface (against only 500 square meters for the boilers of the *Waldeck-Rousseau* croiseur-cuirassé), have proved capable of producing one-fifth more power than designed for, so much so that, on paper, our expert mechanicians consider the *Duguay-Trouins* good for 120,000 horsepower if needed.

The *Duguay-Trouins* have been designed on exceedingly fine lines, and in this respect excel all cruisers of similar displacement, being longer than the 10,000-ton British *Hawkins.* Their only rivals in that respect appear to be the Spanish *Principe Alfonso* and *Almirante Cervera,* of 7,900 tons, that are built on lines closely resembling the French. Obviously the *Duguay-Trouin* and her sisterships have not had their last word in the matter of speed. Much of their eventual fighting worth depends, of course, on their speed excellence, their armament being too weak to enable them to hold quite their own against 10,000-ton, 8-inch gun cruisers of the *Washington* type, although their new model 155 mil. guns mark a substantial advance over the pre-war 6-inch weapons. A further advantage of the *Duguay-Trouins,* when compared with the British *Emeralds,* the Spanish *Cerveras,* and the U. S. *Omahas,* resides in their roomy twin turrets, that afford protection against both shells and gas, especially since up-to-date devices have been found that ensure both ventilation and renewal of pure air. On the other hand, the practical defenselessness of the waterline and motor compartments in the new croiseurs-légers is a matter for general criticism.

The *Lamotte-Piquet,* of the 8,000-ton series, that was built in dry dock at Lorient and floated in March, 1924, is ready for her preliminary trials. The *Primauget,* launched at Brest in May, 1924, is also approaching the trial stage. These two ships have benefited from the experience gained in the *Duguay-Trouin,* and are expected to be rapidly passed through their series of trials. The manning difficulty is being rapidly got over; some 570 officers and men had to be found for each of these greyhounds. The *Duguay-Trouin* is fitted to act as flagship, with an admiral and twenty-two officers, plus four aspirants (or midshipmen).

Trials of flotilla units are taking place at every port militaire. The 2,400-ton *Jaguar* did 34.5 knots for three hours on May 12 off Lorient. She is fitted with Rateau turbines, like her sister ship *Tiger,* and a speed of 36 knots at least is looked for at full power. The *Tempête,* of 1,460 tons, has satisfactorily passed through her preliminary trials at 31 and 33 knots. The Breguet-turbined *Leopard,* of 2,400 tons, has commenced her preliminary trials after shipping her five 130-mil. guns. At Cherbourg the *Bourrasque* has concluded the series of her sea tests and will shortly be placed in full commission.

At Toulon, the Gironde-built *Tramontaine,* of 1,460 tons, has shipped her guns and commenced her sea trials. At St. Nazaire, the 2,400-ton *Lynx* and 1,470 *Siroco* are being pressed forward with a view to delivery in the late summer. Next month the launch is expected of at least two 1,500-ton boats of the second series, notably of the *Alcyon* at Harfleur and of the *Adroit* at Dunkirk. The last-named is the most advanced of the series. At Nantes the Dubigeon yard is pressing forward the *Palme* and

Railleuse. It had been officially stated that eighteen new *torpilleurs d'escadre* of 1,460-1,500 tons would be ready for January, 1927. It is doubtful if these optimistic expectations can be realized, although Minister Leygues is urging the importance of quick and economical constructional work. Unbusinesslike methods on the part of the Admiralty are blamed for the delays experienced.

French naval aviation is making very slow progress. We have no flying admirals, no faith in the aerial wing, and as yet no doctrine as to the tactical utilization of seaplanes and as to cooperation between navy and aviation. Private firms are vieing with each other in tackling the problem of the seaplane, but their efforts meet with little response on the part of Rue Royale. Competence, will, and authority appear to be lacking. The 25,000-ton *Bearn,* for the last three years undergoing transformation into a "porte-avions" at La Seyne, is ever transforming and improving. Minister Leygues stated that she is as fast as British seaplane carriers, but this is very doubtful.

The conclusions of Commander Robaglia's report on the naval program have been adopted. They provide for the laying down within the next twelve months of nineteen units, namely, one 10,000-ton cruiser, three 2,700-ton destroyers, four 1,500-ton pilleurs d'escadre, one 3,000-ton submarine, five submarines of 1,500 tons, one minelaying submarine, a 5,000-ton submarine mothership, two motor-tankers, and a 5,400-ton cadetship. The 8,000-ton *Primauguet,* built in Brest Arsenal, but engined and boilered at St. Nazaire, did satisfactory preliminary trials off Ushant on June 9. Her sister ship, *Lamotte-Piquet,* has similarly put to sea with like results. The unlucky 2,400-ton *Léopard* broke down again when going at 34 knots. This epidemic of condenser troubles has entailed a revision of engines on board most new vessels.

The efficiency of the French submarine force has increased materially since the war. Few additions have as yet been made to the numerical strength; but training and fighting preparedness have been improved to a very considerable extent. Hard work at sea did it, and also close cooperation between ingenieurs and officiers de vaisseau of the underwater branch. Whereas in pre-war times state arsenals monopolized submarine construction and so-called secrets, a system that proved an obstacle to progress and efficiency, the capabilities of the best private yards have within the last few years been called to the rescue. Emulation has done wonders; it has given birth to a new submarine fleet which French experts with good experience of French submarines genuinely consider to be the most reliable in the world. Make-believe and paper qualities have systematically been banished from French submarine designs, our naval men well knowing from costly experience that in the submarine line, more perhaps than in any other, "the proof of the pudding is in the eating." Pre-war Gallic underwater craft were formidable and splendid on paper, but proved very disappointing at sea. Things have now been reversed. The new *sousmarins de grande patrouille et de défense côtière* have not been made for prize getting at exhibitions, but for hard, rough, prolonged sea service under war conditions, for prolonged cruising and fighting endurance, for habitability and handiness.

French submarines are too small for competing in the matter of long cruising with the British *K 26* and *X 1*—at least for the present, for the 3,000-ton *Redoubtable* and *Vengeur,* now building at Cherbourg, are expected to attain excellence in that line. The Paris Admiralty is satisfied with one month's cruising under war conditions; a test which all new craft of 1,000 tons and above are required to make before joining fully-commissioned flotillas. It is reckoned that officers and men having undergone that pleasant téte-à-téte ordeal with their ship for four weeks at a stretch, diving, experimenting, and planning attacks every day, will be just in the

state of mind desired to fight her to good advantage in case of sudden emergency.

On June 7 the new submarine *Requin*, recently completed at Cherbourg, left that port in company with the ex-German *U 117*, now *René Audry*, for one month sea-cruising and tactical maneuvering. Exercises took place en route for Brest with seaplanes and the gunboats *Aisne*, *Arras*, and *Oise*. The fight was renewed off Brest with defensive craft from that base. From Brest the two submarines will steer straight for Dakar, the West African point d'appui, that is 2,400 miles off. After seaplane exercises, a four-day rest will be granted to the crews, after which a run will be made from Dakar to Las Palmas and then to Casablanca, where seaplane exercises will take place. After a five-day sojourn in the fine Moroccan port, the return journey will commence via Gibraltar. In sight of the great British stronghold the *Requin* and *René Audry* will part, the former making for Algiers and the latter for Lisbonne, and then for Brest. From Algiers after a four-day rest, the *Requin* will proceed to Toulon and join the flag of Admiral Violette, who within a few months' time will have under his command five powerful and war-worthy 1,500-ton submarines. The *Requin* type, that has up to date eight representatives in service or under trial, is smaller than the British *Oberon*, but possesses higher buoyancy. It displaces 1,140 tons on the surface and 1,450 tons when submerged; the length is 82 meters overall, and the width nearly 7 meters. The motor-power for surface propulsion does not exceed 2,900 horsepower, whereas the U. S. *T*-class of similar displacement develop over 4,400 horsepower. The radius of action of 7,000 miles on paper will be slightly higher in practice, fuel consumption being lower than stipulated. The torpedo armament is remarkably strong, comprising ten torpedo-tubes, with sixteen torpedoes of 22-inch bore (thirty-two torpedoes in the latest boats). The surface armament only includes a 4-inch quickfirer, as the French do not believe in guns for submarines. Conditions of habitability mark progress on anything the Germans achieved with larger boats.

The unprecedented aerial inspection by Admiral Dumesnil of naval points d' appui in North Africa marks the dawn of a new era in French maritime developments, viz., the official acknowledgment of the importance of air power in the Mediterranean. Up to the present naval aviation in France existed mostly on paper, admirals in power not believing in flying machines, doing nothing for them, forgetting to utilize the 164,000,000 francs voted for the navy in 1924-25, and that was lost to the navy, with the result that the well-managed, go-ahead Italian naval aviation (for which 700,000,000 lire have just been voted) has assumed a tremendous superiority over France. Time will be necessary to make up for lost time. The best brains in the service will henceforth tackle the thorny task of creating an efficient French aviation in a minimum of time. Admiral Dumesnil, who is the most trusted French war chief, is giving an example that will tell. At the head of three Goliath seaplanes he flew from Toulon to Bizerta, from Bizerta to Bone (bombarded in the last war by the *Goeben*), and then on to Algiers and Oran, that is fortified and earmarked to serve as a torpedo and aerial base in war time. From the seashore he is to fly to Fez, and there to inspect the naval aviation group, whose intervention in the Riff war proved so decisive.

Moreover, things are improving in France. Admiral Frochot, an energetic officer with fine war records, has been appointed in charge of the aeronautical department in place of Captain de la Borde, a practical expert, who is to assume command of the 25,000-ton seaplane carrier *Bearn*, on the eve of her sea-trials at La Seyne. General Hirgchauer, the well-known aerial expert, is also flying over the North African border in a war plane. The Bizerta aerial force comprises twelve heavy Goliath bombardment machines, a number considered as being totally inadequate for the defense of

the Tunisian stronghold. The new super-Goliath is a powerful machine, capable of carrying six tons at a good height.

A slight addition is to be made to the program leger in the shape of a sea-going schoolship for cadets. The twenty-seven-year-old Croiseur *Cuiras sé Jeanne d'Arc*, of 11,300 tons that has been fulfilling such duties for several years past, is utterly worn out, and her upkeep in commission is entailing a yearly growing bill (1,500,000 francs in 1925). The 14,000-ton *Renan*, *Quinet*, and *Rousseau*, that had been proposed in replacement, are too old and too costly in upkeep, besides having ridiculous appellations unbecoming men-of-war. Consequently a special vessel will be built to serve as *batiment ecole d'application des enseignes de vaisseau* with the following characteristics: 5,400-ton displacement (14,000 francs per ton), total cost about 70 million francs, 20-knot speed, with turbines, oil, or coal fired, radius of action of 5,000 miles at 14 knots, armament of seven 155 mil., four 75 mil., and two 40 mil. guns, plus two 22-inch torpedo tubes and two seaplanes. She will be fitted besides with up-to-date appliances against mines, torpedoes, gas clouds, and bombs, as well as for smoke production and submarine detection. She will have room for 125 cadets, who will be placed under unrivalled conditions for thorough experimental and scientific training.

GERMANY

Rebuilding the German Navy

The Engineer, 18 June, 1926.—The publication of the German navy estimates for 1926-27, coinciding with news of the construction of warships in German yards, has directed attention to the gradual but steady progress that is being made towards restoring that naval power which seemed so recently to be shattered beyond repair. Judging from the relatively large sums which the Reichstag votes year after year for naval purposes, the will to sea power still persists in Germany. The desire to possess an efficient fleet, even though it be of modest dimensions, is natural enough in the circumstances in which Germany finds herself today. She has already resumed her former place as one of the great shipowning and trading communities, and a certain measure of naval protection for these important maritime interests is not merely desirable but essential. Nationalist propaganda has no doubt played some part in keeping alive the spirit of enthusiasm for the fleet, but we are inclined to think the more sober elements in Germany are supporting the movement from motives less open to suspicion. Be that as it may, her efforts to build up a new fleet need cause no apprehension on this side of the North Sea so long as the restrictions imposed by the Versailles Treaty remain effective. The process of reconstruction may be said to have begun in March, 1919, when a bill for the foundation of a "provisional Reichs-Marine" was passed by the National Assembly at Weimar after a speech by Herr Noske, the Minister of Defense, who declared that a new navy was needed "to safeguard the transport of foodstuffs, to remove mines, and to protect the fisheries." Later in the same month the German Admiralty was reconstituted, the officer in charge being given a seat in the cabinet, though only in an advisory capacity. This important step has had the effect of grouping all departments of the service under one head, a system which never obtained under the Imperial *régime*. In October, 1920, the Reichstag appropriated 25,000,000 marks for the building of a new cruiser, which has since been completed and placed in commission under the name of *Emden*, thus commemorating the raider which caused such heavy loss to Allied shipping in the war. In 1921 the first two German battleships were placed in full commission. They were, of course, old pre-dreadnoughts, of limited fighting value. Other ships have since come into service, and by next year the active fleet will probably have attained the full strength authorized under the Versailles Treaty, viz., six

battleships, six cruisers, and twenty-four torpedo craft. The *personnel* now consists of nearly 14,000 officers and men, the former serving for twenty-five years and the latter for twelve years. There is every reason to believe that the long-service volunteers are more competent and trustworthy than the three-year conscripts by whom the old Imperial Navy was manned. The proportion of commissioned and warrant officers is somewhat large, representing as it does about 18 per cent of the total.

In 1922 and subsequent years the Reichstag adopted navy estimates which show a progressive increase, culminating this year in a vote of £10,165,000, an increase of £2,410,000 over the estimates for 1925. It is interesting to learn that this relatively large sum was voted after a very brief discussion. In the current estimates new ships and armaments account for no less than £2,705,000, an increase of 33.5 per cent on last year's vote. A second cruiser was begun in 1925, and this year two further ships of the same type are to be laid down. Provision has been made, so far, for four cruisers, each to cost £1,420,000; twelve destroyers at £270,000 apiece, and one experimental torpedo boat at £100,000. In all, therefore, a sum exceeding £9,000,000 has been set aside for new construction. Further vessels are projected. Substantial grants have also been made for reconditioning old ships, for new guns, torpedoes, and mines, and for carrying out experiments. The exact amount which Germany has spent on her navy from 1919 to the current year is not easy to determine, but is believed to exceed £50,000,000. The terms of the peace treaty require Germany to limit the displacement of her future armored ships to 10,000 tons, of cruisers to 6,000, and of destroyers to 800 tons; but in spite of these restrictions, German designers appear to be turning out some very efficient ships. While the new *Emden*, of 6,000 tons, is slower by 5½ knots than our 33-knot *E*-class cruisers of 7,600 tons, she has a heavier armament and a larger steaming radius. Further, the new German destroyer *Moewe*, though displacing only 773 tons, is designed for a speed of 33 knots, and mounts four 4.1-inch guns, besides four torpedo tubes. Building activity is confined for the present to cruisers and destroyers, but the question of replacing two of the oldest battleships is now under consideration, and various tentative designs for an armored vessel of 10,000 tons have been prepared. Great speed is not regarded as imperative in a ship of this type, the primary function of which would be coast defense. Most of the weight would therefore be available for armament and protection, and it should be possible to provide four, if not six, heavy guns, together with adequate defense over vital parts. Such a vessel would necessarily be inferior in every respect to a dreadnought, but it would represent a "Machtfactor" of some considerable weight in the northern seas of Europe, where, apart from the two or three dilapidated dreadnoughts under the Soviet flag, no capital ships above the coast-defense category are to be met with. The question to be resolved, however, is whether a small battleship, costing about £3,000,000, offers a better investment from the point of view of coast defense than a flotilla of new destroyers or a flock of high-speed motor torpedo craft, the designs for which have also been prepared. The final decision rests with the naval staff, and we shall probably learn what it is when the next estimates come out.

In the meantime, the "condition of absolute impotence" to which, according to certain German writers, their navy has been condemned is by no means apparent to foreign observers. That the small fleet now in service is overshadowed by the major navies is certainly true. But Germany, for obvious reasons, does not yet aspire to regain the commanding position at sea which she held before the war. Even her most ardent patriots are constrained to admit that their country's naval policy must be guided for many years to come solely by considerations of self defense. Now, without venturing into the realm of politics, every onlooker perceives that German's immediate problem of naval defense is centered in the Baltic. If her north-

ern maritime frontier is adequately guarded, she may feel reasonably safe from external aggression. When the naval resources of the various Baltic states are compared, the superiority of the German Fleet in all the elements that count is found to be very marked. Sensational rumors of Russian naval activity are heard from time to time, but still await confirmation. News from every reliable source is such as to suggest that the Russian Fleet remains miserably defective in *personnel* and material. Much is made of the fact that it contains two dreadnoughts; but these vessels, although seaworthy, would require to have their propelling machinery entirely renewed before they could approach their legend speed. Their best pace at present is about 16 knots. Two, or perhaps three, of the cruisers are effective, but it is to be doubted whether more than a dozen other vessels, including submarines, could put to sea at short notice. There is admittedly a woeful shortage of technical equipment, the fire-control system is obsolete, and even the ammunition for the guns is the residue of war stocks. The dockyards are unable to execute heavy repairs, owing to the deterioration of plant and the dearth of skilled workmen. As for the *personnel* of the fleet, probably the less said about it the better. The Soviet authorities are now inviting elderly officers of the old Tsarist navy to assist in rendering the fleet efficient, a task which appears to have defied every effort up to the present. In view of these facts, there can be no serious question as to the superiority of the German Navy, over the heterogeneous collection of ill-found and badly manned ships which comprise the Russian Baltic fleet. If the German vessels are old, they are in fairly good repair, they have trained and disciplined complements, and they are periodically exercised at sea. In short, the Germany Navy of today is a relatively strong and efficient force, which should be capable of holding its own against any prospective opponent. Its further development on the material side is assured by the substantial program of new construction now in hand.

New Navy Estimates

Journal of Royal United Service Institute, May, 1926.—The German navy estimates for 1926 provide for a total outlay of 203,000,000 marks (£10,165,000), an increase of £2,410,000 over those of the previous year. The personnel provided for is 8,515 with the fleet, and 4,646 in shore establishments, the combined total being 1,839 short of the maximum of 15,000 allowed by the peace treaty. A large increase for new ships and their armaments is to be incurred. Following the cruiser *Emden*, the completion of which was recorded in the last *Journal*, a second vessel, *B*, has been laid down at Wilhelmshaven, and two more, *C* and *D*, are projected in the 1926 estimates, but not yet authorized. Six destroyers, *W.102-107*, are building at Wilhelmshaven, and six more are in the estimates, but not yet authorized, to be laid down in 1926. They are of 773 tons, 34-knot speed, and carry four 4.1-inch guns and four torpedo tubes. A torpedo boat also figures in the new estimates. Submarines, of course, are forbidden by treaty. It is proposed to begin the replacement of the battleships on the list, all of which are over twenty years of age from date of laying down, but under the peace treaty, the vessels to follow them must not be of more than 10,000 tons.

JAPAN

Japanese Naval Policy

Naval and Military Record, 2 June, 1926.—A news agency cablegram from Tokio recently stated that the Japanese Government proposes to embark upon a more active policy of naval construction. If this announcement proves to be correct, such a decision seems rather curious on the eve of a preliminary conference upon international disarmament in which Japan is taking part. It is probably true to say that we have little real knowledge of

what Japan is doing nowadays in the way of naval development. She is faithfully observing the conditions of the Washington Agreement; on that point there is no question. But her integrity upon this point leaves her abundant scope for expansion in other directions—and directions more suited to her strategical requirements than those which are prohibited under the Washington Agreement would have been—and there is really no reason to expect that she should voluntarily take the rest of the world into her confidence. We are told that financial stringency militates against any big schemes of naval construction, such as a large and powerful party strongly advocates, but the simple truth is that no first-class power has ever yet stultified warship construction for want of money when she has made up her mind that she wants ships.

Japan is a great insular and a great sea-trading empire, and sea-power to her stands in very much the same relations as it does to ourselves. In such a position she is justified in following any line of naval policy she may choose, so long as it does not trench upon international treaties, on the simple plea of national security. There is no reason to believe that the Japanese are actuated by any bellicose motives, but there is every reason to believe that they mean to take their own part to the utmost should the challenge ever arise. With quiet determination they have made up their mind as to what they want and what they must have, and while they favor the principle of peaceful attainment of ends which are becoming essential to their national needs, they will not shirk war if they are denied these ends.

Objective Policy

We may take this Tokio message in conjunction with an announcement recently made in the United States to the effect that Congress is sanctioning a large expenditure upon naval bases in the Pacific. There is no more reason why the United States should not spend as much money as she pleases upon naval bases in the Pacific than there is why we should not spend what money we choose upon Singapore. But in naval matters an objective policy always calls forth a responsive policy.

The reason for developing Singapore has been so long and so often explained that it must be clear enough to all people in this country, whether they may agree or not. But it postulates the necessity to protect British dominions and British commerce against some tangible menace, and the naval powers in a position to create such a menace naturally look at the matter from their own point of view.

If there were no great sea power in the Pacific, the development of Singapore would be an extravagant farce. If there were no great sea power in the Pacific, the sanctioning by Congress of an outlay of some millions upon naval bases would be squandering money. If there were no other sea power in the Pacific, any more active policy of warship construction by Japan would be purposeless. Of course, all this is very elementary. But if we begin speculating as to why Japan is contemplating greater shipyard activity on the eve of coming to Geneva, and why the United States is voting money for naval bases on the eve of coming to Geneva, we must try and get down to first causes. Rivalry in fighting strength may be carried on upon perfectly friendly lines, and without the least unfriendly intent. But such a spurt in the competition as is now suggested does not somehow lend an air of much sincerity to the idea of an international conference designed to check precisely what is being done on the very eve of it.

Japan's New Cruisers

If the information so far available prove authentic, the new Japanese cruisers *Furutaka* and *Kako* will be extraordinary ships. Mr. Maurice Prendergast, the well-known naval writer, calls them Japan's "Surprise Ships," in an article which he contributes to *The Navy*, and he explains

that the navigating bridges, charthouse, and fire-control tops appear to be built up, in ascending stages, into some form of "tower" or "box" mast. Four funnels are stepped, but the first and third funnels are so raked aft and united to the second and fourth funnels that the ships have the appearance of vessels with two funnels only. The *Furutaka*, by means of her tubes mounted on traversing carriages, can fire salvoes of twelve torpedoes on either beam; and in this respect she is unique among war vessels. Four anti-aircraft guns of 4.7-inch caliber are said to be provided, and the design further includes means for the carrying (and launching into flight) of two airplanes.

Taken all round, Mr. Prendergast declares, these new units of the Imperial Japanese Navy possess remarkable power of attack and swift movement, and are much more formidable vessels than the British cruisers *Emerald* and *Enterprise* (the latter recently completed at Devonport), of exactly the same displacement—7,100 tons. Japanese naval construction today exhibits a commendable degree of originality, and the new cruisers are a refreshing novelty at a moment when European cruiser design has lapsed into an almost stereotyped form of vessel.

Japanese Naval Notes

Cruiser "Furutaka" Delivered

The *Furutaka* (7,100 tons) was delivered to the Japanese Navy on March 31, 1926. She will leave Nagasaki on April 8 and sail to Yokosuka via Sasebo. The commanding officer will be Captain K. Shiozawa.

Submarine Launchings

Submarine *I-21* (1,000 tons, mine layer) was launched at the Kawasaki Dockyard, Kobe, on March 30, 1926.

Submarine *I-51* (1,400 tons) was launched at the Sasebo Navy Yard on March 15, 1926.

Submarine *Ro-67* (998 tons), building at the Mitsubishi Dockyard, Kobe, was launched on March 18, 1926.

Submarine Periscopes

It is reliably reported that patents have been granted in Japan for two types of German submarine periscopes. One of these is the Goerz type, referred to as "periscope a oculaire fixie (standsehorhr) brevete," which is provided in lengths from 6.2 meters to 15 meters maximum. The other periscope is known as Humbrecht (Doctor Konig—Fernrohre und Enefernungamesser) and is built to the same design principles as the Goerz type above. The Goerz type above is not used in Japanese submarines and is criticized by the Japanese naval people as being too heavy and as having unreliable and unsatisfactory housing apparatus. It is not known whether or not the Humbrecht periscope is used by the Japanese Navy.

Replacement Program

A reliable informant has stated as his opinion that the Japanese naval replacement program will consist of four 10,000-ton cruisers, twenty destroyers of about 2,000 tons each, five submarines of about 2,500 tons each, one repair ship, one tanker, one aircraft carrier, and three gunboats.

The yearly allotment of funds for the construction of the above ships is to be as follows:

1926-27	Y8,000,000
1927-28	28,000,000
1928-29	50,000,000
1929-30	120,000,000
1930-31	120,000,000
Total	326,000,000

ITALY

Italy's Naval Ambitions

Naval and Military Record, 9 June, 1926.—The Italians are our very good friends. The comradeship of the Great War cemented an understanding which was based upon centuries of mutual goodwill. I believe it is true to say that in all European history no two powers have ever been less at variance than Great Britain and Italy. She has accepted our naval dominance of the Mediterranean as dictated by a policy which has absolutely no hostile reference to herself. But time inevitably brings changes. There is no reason to believe that the friendly spirit, so marked during the recent interchanges of naval visits is likely to alter. But Italy's outlook upon the whole subject of sea power is certainly undergoing a change, and the matter is one of vital interest to this country.

Signor Mussolini has completed the work which the Great War began. No nation has risen in prestige and prosperity to the same degree as Italy during the past eight years. She has regained the territories long since stolen from her by the patchwork Austrian Empire. She has recovered the undisputed mastery of the Adriatic. Her people have been welded together in a fervent wave of nationalism inspired by the magnetic individuality of *Il Duce*. She has "found herself" as never before since she became a kingdom, and ambition is not unnaturally following upon achievement.

Nebulous at present, but likely to assume the form of a definite aspiration, that ambition is conceiving an Italian Empire. Mussolini has confessed to this dream. But does he really regard it as a dream? None can know better than he how the ardent temperature of the Italian people is likely to be fired by the idea of return of the ancient dominance of the Cæsars. And there are very practical considerations at the back of this splendid vision. Italy is feeling the need for economic expansion, and for increased room for her growing population. She sees directions in which it ought not to be difficult to materialize her political ambitions. An empire cannot be created in a day. She may be prepared to work and to wait for years. But the conception is there, and already is she working toward its ultimate consummation. She is beginning to stretch out towards a wider greatness.

The Italian Fleet-in-being today is of but modest proportions. The national resources for expanding that fleet are very much more extensive than the world in general realizes. Italy is a great shipbuilding country. But at present she does not need to embark upon any ambitious program of naval construction. She may never need to do so, for she would much prefer to attain her purpose by peaceful means; by the influence of power rather than by the exercise of strength. Warships are not her present concern. She is beginning at the right end, by the creation of a chain of strong strategical positions, the mere possession of which will radically change her whole position in the Mediterranean.

Mussolini's seizure of the Island of Corfu was something more than a dramatic gesture, although he would probably prefer that it should be thus regarded. Rhodes is to be developed into a big naval base. The creation of a battleship base in Sicily has been determined upon. The selection of suitable spots for submarine and aircraft stations is known to be engaging the attention of the Italian Government. There is sufficient political justification for anything and everything that Italy may do in this way. She is very vulnerable to attack by sea, therefore she may reasonably plead the counsels of mere prudence in creating an extensive chain of defenses to guard her shores against attack by sea. The obvious answer that no power can conceivably contemplate attacking Italy by sea can be easily and logically met. Italy is a Mediterranean power. But the strongest naval force in the Mediterranean is not maintained by a Mediterranean power at all. Suppose that the preponderating naval force in the Channel were Italian, with

Guernsey as a base, and Calais (let us say) as a key position, should we feel under any necessity to apologize to the rest of the world for establishing strong naval bases in the Isle of Wight and the Scillies?

To be sure the analogy is rather ridiculous, but it serves to enable us to understand the Italian point of view. In its turn, however, this point of view, however generally it may be accepted by the Italian nation, is largely "eyewash." Italian statesmanship does not really contemplate these new bases as a defensive necessity. They are the first material fruits of her new and spacious political ambitions. There is only one disquieting consideration to my mind so far as this country is concerned. How far may Italy's naval ambitions presently result in a new orientation on her part towards British sea power? From a tacit acquiescence in our predominance in the Middle Sea when may she come to regard us as usurpers?

That every good Italian regards Malta as a legitimate Italian island and, therefore, an illegitimate British island, is a simple matter of fact. Malta as an Italian naval base would give Italy a position of absolute command in the central Mediterranean. Malta as a foreign naval base must always be a thorn in the side of any such aspiration. Probably it is true to say that Italy would sooner see Malta in possession of Great Britain than of any other nation. But this still leaves the view that Malta ought to be Italian. The point is only likely to become more than an unspoken thought should the destiny of Italy ever bring her to a stage when her policy might give rise to demur in this country. That her naval ambition is never likely to become directly inimical to British interests may, I think, be taken for granted. Her eyes are not directed towards any British territories. She has no thought of interfering with the great flow of British trade through the Mediterranean.

What, indeed, is her policy, as expressed by the creation of new naval bases as the first material step in naval expansion? The Island of Rhodes would constitute a strategical position of first-class importance in any enterprize aimed in the direction of Asia Minor. In the Eastern Mediterranean sea power is a negligible quantity. The combined navies of Turkey, Greece, and Jugo-Slavia are unlikely to be worthy of serious consideration for many years to come, and that they ever would be combined is amongst the permanent improbabilities of the political world. Italy is now energetically developing her new colonial possession west of Egypt. She has long had a languishing eye on the wide expanses of African territory which lie beyond the British zone, and has not yet forgotten her Abyssinian adventure. The Jarubub agreement has set limitations to her scope, but not to her ambitions. Tunis, although French, has become almost Italian through steady infiltration, but here is a prospect dangerous to contemplate. I would not say that in the present patriotic temper of the Italian nation they would shrink from entering upon a war which promised to lead to lasting conquest. But wars of this sort have become very unpopular in the present-day world, and I do not believe that Italian statesmanship seriously contemplates anything of the kind.

Asia Minor offers possibilities of exploitation. Turkey has few friends left, and those mainly actuated by self-interest. Frankly, the professed friendship of Italy for Turkey appears to me to be suspiciously insincere. The assistance given to Mustafa Kemal to turn the Greeks out of Anatolia was not prompted purely by dislike of the Greeks nor love for the Turks, any more than Japanese interest in Manchuria has anything to do with affection for the Chinese. I very much doubt whether anybody in this country would be in the least concerned about anything Italy might do, or attempt to do in Anatolia. But there are other countries which would be very much concerned, and herein lies the disquieting consideration.

Anyhow, there is the fact: Italy is entering upon a new era of naval expansion in the Mediterranean. The long-standing menace of the Adriatic has been wiped out, and so she prefers to believe that a new menace may

come from the outer sea. France is, apparently, too much preoccupied with her own troubles to pay much heed to this new phase of naval rivalry, particularly as it trends eastwards, and, therefore, away from the interests. But it is not likely that she will long remain indifferent to any serious prospect of a complete change in the balance of power in the Mediterranean. Russia is such a dark horse nowadays that it is really rather profitless to speculate concerning her, but if she were to build up a Black Sea fleet again, as she might do, and enter into a compact with Turkey, then any adventure in Asia Minor would assume a more risky aspect.

Italy today is fired by a wave of patriotism which is quite ripe to develop into militarism. This is what gives a particular significance to her new line of naval policy. At the moment it holds no visible threat to anybody. But one can scarcely conceive that it means nothing more than a mere spectacular gesture, designed to appeal to the buoyant enthusiasm of the Italian nation. Italy may reasonably say that she has just as much right to develop a big naval base in the Island of Rhodes as we have to build one at Singapore. So she has. But our motive has been so fully explained, in addition to being so self-evident, that no other country really has any misconception upon the subject. Italy has not vouchsafed any explanation as to why she is fortifying Rhodes. I am not suggesting that she is under the least obligation to do so. But she can scarcely deem it unfriendly that there should be a certain degree of speculation upon the subject.

From the British point of view, I think, a powerful Italian Navy is to be regarded as a desirable condition. I suppose we shall continue to regard the Mediterranean as our principle naval zone, unless a totally unforeseen change occurs in the present posture of world affairs. Malta is the nearest naval base to the great dominions, the road to which lies through the Suez Canal. The Middle Sea represents the interior lines of strategical distribution. Our simple doctrine is the freedom of the seas. That Italy likewise stands for this doctrine there can be no reason to question. France will probably only concern herself in the matter from the point of view of her national prestige. She can no more suppose that Italian naval ambitions are directed against her than is the policy under which this country elects to keep a dominant fleet in the Mediterranean. We must realize that now the Austrian Empire has disappeared Italy occupies a very different position in Europe. That she should be looking about her with the idea of developing opportunity to her own national advantage is, after all, only natural. Greece is rather perturbed about the fortifying of Rhodes and has made diplomatic representations that Cyprus might be handed over to her. Our foreign office has replied quite definitely that there is no idea of handing Cyprus over to anybody. We do not intend to fortify the island ourselves, but we are quite determined that no other power shall fortify it. Turkey is probably a little puzzled over a policy which somehow seems at variance with Italy's attitude of friendliness towards her. If Anatolia is the ultimate goal of Italy's ambition—and the suggestion does not seem an extravagant one—then the creation of a big naval base at Rhodes stands fully explained. Otherwise, we can only assume that, having emerged from the Adriatic, to which political conditions had so long chained it, the Italian Navy now seeks to spread itself over the Mediterranean to the furtherance of that influence and the enhancement of that prestige which follows in the wake of showing the flag.

AVIATION

Appointment of Professor E. P. Warner as Assistant Secretary of the Navy in Charge of Aviation

New York *Times*, 1 July, 1926.—Although a young man, Professor Edward P. Warner, whom President Coolidge has nominated as Assistant

Secretary of the Navy in charge of aviation, is a leading authority upon aeronautics. He is also an enthusiast. A better appointment could hardly have been made. Professor Warner is learned in the theory and mechanism of flight, but at the same time he is eminently practical. He has done pioneering work for commercial aeronautics. He has what is commonly called "vision." But he keeps his feet on the earth. He is highly regarded by the Massachusetts Institute of Technology, with which he is associated. That of itself is a definite recommendation. Professor Warner was one of the six chosen by Secretary Hoover a year ago to undertake, with the American Engineering Council, a survey of commercial aviation here and abroad. The committee made its report last January. Secretary Hoover said that "the public and Congress would do well to give prompt consideation to the conclusions of the committee." It recommended a Federal policy to promote civil aviation, maintaining that conditions in this country were "the most favorable in the world." Chiefly the government was urged to provide lighted airways, emergency fields, maps, charts, radio, and an adequate air service, and to extend the use of aircraft in non-military government activities.

While Professor Warner is prominently identified with commercial aviation, he has conducted a postgraduate course for officers of the Army and Navy at the Institute of Technology. In both services he is well known and acknowledged to be an authority. He has been opposed to direct subsidies, doubting their ultimate benefit. But he holds that laying out landing fields is a function of government, agreeing with Mr. Hoover that there is no reason why the government should not aid commercial aviation with facilities similar to those that shipping enjoys, and without which it could not function. He has advocated contracts with private companies to carry the mails in airplanes.

In brief, the man upon whom President Coolidge's choice has fallen is independent of military influences, and will bring to his duties a knowledge of the art of aviation such as few civilians possess. In him the Navy has drawn a prize. The President wisely turned away from proposals that he appoint naval officers to the new and important position. Assistant secretaries for aviation are also to be named for the War and Commerce Departments. May Mr. Coolidge be as happy in his other selections.

Scientists Verify Byrd's Calculations

New York *Times*, 30 June, 1926.—Lieutenant Commander Richard E. Byrd arrived at the North Pole "very close" to nine hours three minutes Greenwich civil time on May 9, the committee of experts named by the National Geographic Society finds after a careful examination of his data. His calculations are verified in "every particular" and the scientists' final calculation varies only one minute from that of the polar flier.

They add that flying at and about the Pole at an altitude of 3,000 feet Commander Byrd's field of view was a circle more than 120 miles in diameter and thus the Pole, itself, was "within his ken" for more than two hours.

Commander Byrd's return to Grey Hook, Spitzbergen, the scientists conclude, demonstrates his skill in navigating along a predetermined course and in their opinion is one of the strongest evidences that he was equally successful in his flight northward.

Knew Where He Was At All Times

"The feat of flying a plane 600 miles from land and returning directly to the point aimed for," they assert, "is a remarkable exhibition of skillful navigation and shows beyond a reasonable doubt that he knew where he was at all times during the flight."

Commander Byrd's records were transmitted by Secretary Wilbur to the society for study and were today returned to the Navy Department with the report of the scientists. These records included two charts on which Commander Byrd wrote his observations, made his calculations and plotted his position.

The special committee of the society which examined the documents and the sextant used by Commander Byrd consisted of Dr. Gilbert Grosvenor, President of the society; Frederick V. Coville, and E. Lester Jones, director of the United States Coast and Geodetic Survey, while the committee of scientists who checked by on the calculations was composed of Hugh G. Mitchell, senior mathematician of the United States Coast and Geodetic Survey; Henry G. Avers, chief mathematician of geodesy of the Coast and Geodetic Survey, and Albert H. Bumstead, chief cartographer of the National Geographic Society and inventor of the sun compass which Lieutenant Commander Byrd carried with him on his successful flight.

In forwarding the report to the Secretary of the Navy, Dr. Grosvenor said:

"I take this occasion to extend to you personally and to the Navy Department, our heartiest congratulations on this wonderful achievement by a navy man."

Text of the Board's Report

The report of the special committee appointed by the Board of Trustees of the National Geographic Society to examine the records of Commander Byrd's flight follows:

"The committee has examined the original records of Commander Byrd and found them to have been carefully and accurately kept. In the opinion of the committee, these records substantiate in every particular the claim of Commander Byrd that on May 9, 1926, he reached the North Pole by airplane, thus being the first person to reach the North Pole by aerial navigation.

"The committee has had expert assistance in the examination of the records from Hugh G. Mitchell, senior mathematician of the United States Coast and Geodetic Survey; Henry G. Avers, chief mathematician of geodesy of the Coast and Geodetic Survey, and Albert H. Bumstead, chief cartographer of the National Geographic Society.

"These experienced calculators have verified all of Commander Byrd's computations, devoting five consecutive days to the work; they have also critically examined the sextant used by Commander Byrd.

"Their examination began at 10 A.M. on June 23 and was completed at 5 P.M. on June 28. The results of their examination are attached to this report.

Gilbert Grosvenor,
Frederick V. Coville,
E. Lester Jones.

June 28, 1926."

Text of the Scientists' Report

The report of the experts who assisted the special committee in the examination of Commander Byrd's records was also made public today. It reads:

"Washington, D. C., June 28, 1926.

Dr. Gilbert Grosvenor, Dr. Frederick V. Coville, Colonel E. Lester Jones, National Geographic Society, Washington, D. C.

"Dear Sirs: We have the honor of submitting the following report of our examination of Lieutenant Commander Richard Evelyn Byrd's navigation report of his flight to the Pole. We have carefully examined Commander Byrd's original records of his observations en route to and from the North Pole.

"These records are contained on two charts on which Commander Byrd wrote his observations, made his calculations, and plotted his positions. We have verified all his computations. We have also made a satisfactory examination of the sextant and sun compass used by Commander Byrd.

"The plane left Kings Bay, Spitzbergen, at 00 hour 37 minutes, Greenwich civil time, May 9, 1926, passed the north end of Amsterdam Island at 1 hour 22 minutes, G.C.T., headed north following closely the 11 degree 04 minute minute meridian of east longitude.

The dead reckoning position of the plane is given for hourly intervals, after leaving Amsterdam Island and also at the times sextant observations were made. Ten sextant observations to determine the altitude of the sun were made, six at various intervals between Amsterdam Island and the Pole and four while the plane was flying at the Pole. The accompanying chart shows the route and the positions when observations were taken.

"Under the conditions of flying it is manifestly impossible to make more than one astronomic observation from any one point. A single astronomic observation does not give a location but only a line passing through the position of the observer. Such lines are called sumner lines. If the latitude or longitude of the point of observation is known or its direction or distance from some known point, the position on a sumner line may be determined.

"In the present case we have both the direction and the estimated distance from Amsterdam Island to give the position on the sumner lines resulting from the sextant observations of the altitude of the sun.

"The resulting positions obtained by using the direction may differ from those obtained by using the estimated distance. This is to be expected. The distances depend upon estimates of speed and estimates of speed depend upon altitude of the plane obtained with an aneroid barometer.

"The barometer readings of altitude depend on the assumption that the sea level atmospheric pressure remains constant over the whole route of the flight, something which in ordinary latitudes rarely happens between points so widely separated. We do not know if these conditions are better in the polar regions. It is our belief, therefore, that estimates of speed may be subject to large errors.

"But the direction of flight from Amsterdam Island could be known with a comparatively high degree of precision as it depended only on the skillful use of two optical instruments, the drift indicator and the sun-compass, both capable of giving the direction within one degree. When these instruments were used almost continuously, as they were, it seems probable that the route flown followed closely the route planned, the deviation to the right tending to balance the deviations to the left.

A Check on Steering of Plane

"Attention is called to the fact that the sumner line determined at 4 hours 56 minutes coinciding so nearly in direction with the direction of flight gives a splendid determination of longitude and check on his steering at a point about midway of the flight; just as the one determined at the Pole and intersecting the course at an angle of about 56 degrees gives a good condition for the determination of latitude.

"The amount which the plane may be actually off the sumner line is not affected by inaccuracies of steering, such as enter into the holding of the compass course, or determining and correcting for drift, but are wholly due to errors in the observed elevations of the sun. These elevations were determined with a sextant in which the bubble supplies the horizon of reference, an instrument developed by Commander Byrd and in the use of which he was most skillful.

"An estimate of the error attending such an observation may be obtained by fitting the dead reckoning to the sumner lines and by action

of the capacity of the sextant. From this evidence, it is believed that five miles, plus or minus, represents a reasonable estimate of the limits of this error, which is not accumulative, but is the same for all sumner lines thus determined.

"It may be noted also that in comparing positions determined at 8 hours 18 minutes, 8 hours 38 minutes and 8 hours 59 minutes it becomes necessary to assume errors of only two minutes in the observed altitudes to bring them into full accord with the average speed between the determined positions. This would indicate that five minutes is a very reasonable limit to assign to the uncertainty of an observed altitude.

The Arrival at the Pole

"At 8 hours 58 minutes 55 seconds an observation of the altitude of the sun gave a latitude of 89 degrees 55.3 minutes on the meridian of flight. This point is 4.7 miles from the Pole. Continuing his flight on the same course and at the speed of 74 miles per hour, which he had averaged since 8 hours 18 minutes, would bring Commander Byrd close to the Pole in 3 minutes 49 seconds, making the probable time of his arrival at the pole 9 hours 3 minutes, Greenwich civil time.

"At the time Commander Byrd was close to the Pole he estimated the moment of his arrival there at 9 hours 2 minutes. Our calculations differ from his estimate less than one minute, during which time he would have flown about one mile. From this it appears that he chose the right place to maneuver.

"Flying his plane to the right long enough to take two sextant observations, he turned around and took two more observations. These four observations confirmed his dead reckoning position of the Pole. He then attempted to fly his plane in a circle several miles in diameter with his Pole position as a center.

Pole Visible for Two Hours

"Flying at and about the Pole at an altitude of 3,000 feet, Commander Byrd's field of view was a circle more than 120 miles in diameter. The exact point of the North Pole was close to the center of this circle and in his near foreground, and during more than two hours of his flight was within his ken.

"Soon after leaving the Pole the sextant which Commander Byrd was using slid off the chart table, breaking the horizon glass. This made it necessary to navigate the return trip wholly by dead reckoning. In accomplishing this two incidents should be specially noted.

"At the moment when the sun would be crossing the fifteenth meridian, along which he had laid his course, he had the plane steadied, pointing directly toward the sun, and observed at the same instant that the shadow on the sun-compass was down the middle of the hand, thus verifying his position as being on that meridian. This had an even more satisfactory verification when at about 14 hours 30 minutes, G.C.T., he sighted land dead ahead and soon identified Grey Point (Grey Hook), Spitzbergen, just west of the fifteenth meridian.

"It is unfortunate that no sextant observations could be made on the return trip. But the successful landfall at Grey Hook demonstrates Commander Byrd's skill in navigating along a predetermined course, and in our opinion is one of the strongest evidences that he was equally successful in his flight northward.

"The feat of flying a plane 600 miles from land and returning directly to the point aimed for is a remarkable exhibition of skillful navigation and shows, beyond a reasonable doubt, that he knew where he was at all times during the flight.

"It is the opinion of your committee that at very close to 9 hours 3 minutes, Greenwich civil time, May 9, 1926, Lieutenant Commander Richard

Evelyn Byrd was at the North Pole, in so far as an observer in an airplane, using the most accurate instruments and methods available for determining his position, could ascertain. Respectfully submitted.

HUGH C. MITCHELL,
ALBERT H. BUMSTEAD,
HENRY G. AVERS."

The committee accompanied the report with a chart of the route flown by Commander Byrd from Kings Bay to the Pole and return.

The Royal Aero Club Lunch to Lieutenant Commander Byrd, U.S.N.

The Aeroplane, 2 June, 1926.—On Friday, May 28, the Royal Aero Club entertained at lunch Lieutenant Commander R. E. Byrd, U.S.N., Lieutenant A. B. Parker, U.S.M.C., Lieutenant G. O. Neville, U.S.N.R.F., and Aviation Pilot Floyd Bennett, U.S.N., members of the Byrd Arctic Expedition, the first to fly over the North Pole. Among those present to greet them were Lieutenant Colonel F. K. McClean, A.F.C., Chairman of the Royal Aero Club, Mr. T. O. M. Sopwith, Chairman of the S.B.A.C., Captain W. C. Watts, U. S. Naval Attaché, Commander J. C. Hunsaker, U.S.N., Major H. C. Davidson, U. S. Military Air Attaché, Mr. C. R. Fairey, Sir Henry White Smith, C.B.E., Major H. Hemmings, A.F.C., Lieutenant Colonel W. A. Bristow, Lieutenant Colonel M. O. Darby, Mr. C. V. Allen, Secretary of the S.B.A.C., Mr. H. E. Perrin, Secretary of the Royal Aero Club, and members of the Press.

Lieutenant Colonel Frank McClean, who presided, said that the members of the Royal Aero Club wished to express their appreciation for the wonderful performance in carrying out the North Pole flight and as the premier Aviation sporting club in the World felt the honor of being the first to welcome the members of this very sporting and private venture.

Mr. Sopwith, as chairman of the S.B.A.C., welcomed them on behalf of the British aviation industry and remarked that generations had been trying to get to the North Pole, and with almost the first flick Commander Byrd had got there without a hold-up of any kind.

Lieutenant Commander Byrd, U.S.N., acknowledged the welcome from what he considered the greatest aero club in the world. Although he spoke for over an hour, he modestly devoted nearly half his time to tracing the efforts of the early pioneers of aerial polar exploration. He also recalled his earlier connections with England, first as a patient at the R. N. Hospital at Plymouth, secondly while cooperating with the R.A.F. during the war, and finally as a member of the crew of the ill-fated *R.38* In connection with the last, he mentioned that he had been attending a party in London and missed his train to Howden to join the ship on the day she fell into the Humber.

Amundsen had said, as the result of his previous failures with airplanes, that heavier-than-air craft could not conquer the Arctic, and this had made it hard to collect funds for his expedition. He had approached one millionaire who said that he wouldn't give a damned cent at the time, but if they returned alive he would let them have $10,000 to clear up the mess. However, he had fifty keen volunteers who contributed largely to the success of the expedition.

Apropos the commander of the expedition and the type of machine used, the inimitable Cy. Caldwell had remarked that Commander Byrd belongs to the F.F.V. (First Families of Virginia) and the machine was manufacturned by the L.F.N.J. (Last Family to arrive in New Jersey), an interesting combination taken from the social register and the Immigration List.

All the members of the expedition speak very highly of the Fokker three-engined monoplane. Commander Byrd went on to say that on the arrival

of his ship, the *Chantier*, at King's Bay, Spitzbergen, it was impossible to get alongside the quay owing to the presence of a Norwegian ship, so that the airplanes, the Fokker and a Curtiss Oriole, had to be ferried across the ice at a great risk of total loss should the slightest breeze get up and so cause the ice to break up.

Finally the machine was erected, a runway prepared in the 4-5-foot deep snow, the best pair of skis fitted, the machine loaded up with 26-hours' fuel, food for 3½ months, and all the usual etceteras, farewells taken, but while taxiing one of the skis broke. The second best pair of skis were put on, the same procedure as before gone through to end this time by slewing round into a snowdrift. The third best set of skis were then fitted and again one of the skis jammed and the machine ran into the snow once again. Thereafter the crew were superstitious of saying good-bye and the 600-yard runway came to be known as the "Byrd Boulevard."

The machine was lightened by taking out four-hours' petrol and a lot of miscellaneous impedimenta. The fourth set of skis were clamped onto the third set to make them doubly strong, the crew working through the sunny night to get the machine ready. This time the personnel refused to say good-bye, but sneaked into the machine, a rope was tied round the tail-skid, the engines were opened up, the rope released, and the machine got off.

Once in the air, Commander Byrd found that a considerable amount of gear that he had eliminated had been surreptitiously put on board again, including a ukelele, a Jew's harp, and a pack of cards! Navigation was carried out with the aid of a sun compass which is reputed to be more reliable and enables a straighter course to be steered in the air than is possible with the magnetic compass on the sea.

Before reaching the region of the Pole a leak was discovered in the starboard oil tank, and the engine concerned was cut out, the machine flying successfully on two engines at 60 m.p.h. It was later discovered that the oil was leaking through a rivet hole, and as soon as the oil level fell below that the leak stopped, and the engine was restarted.

On reaching the estimated position of the Pole, the machine was flown round in gradually decreasing circles for 15-20 minutes, and the return flight was begun. No flags were dropped, as Peary had already planted the American flag. The Polar Sea was seen as a waste of snow, and no land or life was discovered.

Commander Byrd claimed no personal pride in the accomplishment, but thanked the good God who gave them the sun, and paid a very earnest tribute to Aviation in general and to Floyd Bennett, the pilot, and the fifty volunteers and sportsmen in particular.

Mr. Floyd Bennett said how pleased he was with the welcome they had received and said that all the credit should go to Commander Byrd who had worked so hard to organize the expedition and who had navigated the machine over the 750 miles to the pole and back, and to Lieutenant Noville, the engineer officer, who had ensured that the engines functioned properly. Under these conditions, the piloting was easy.

As regards the authenticity of their calculations, he claimed that had the navigation on the outward journey been in the slightest degree out, they couldn't have possibly navigated on the return journey to bring them dead over their point of departure, as happened.

Lieutenant Noville also expressed his pleasure at the welcome and said that he could not elaborate on the story.

Lieutenant Parker, who acted as spare pilot, but who, with Lieutenant Noville, was left behind in the interests of economy in weight, said that the midnight sun under which everyone worked so hard reminded him of the song "After you've got what you want, you don't want it." All the crew were anxious to see the phenomenon, but its presence completely upset

their lives, as at no time did they know what particular meal they were supposed to be eating or when to sleep.

The Future of Air Transportation

Engineering, 21 May, 1926.—The future development of commercial air transport cannot be other than highly speculative, but as a result of the experience gained in the last few years, it is clear that for certain services, such as mail carrying, no nation can afford to disregard its possibilities. It is unnecessary to stress the special importance of the problem in the case of the British Empire, the constituent units of which are so widely scattered, and it is somewhat regrettable that, as regards this aspect of aviation, we do not occupy the position, as compared with other nations, that might have been expected to result from our admitted supremacy in fighting and reconnoitering craft during the war. Our present position was surveyed by Air Vice Marshal Sir W. Sefton Brancker, in delivering the fifth Gustave Canet lecture before the Junior Institution of Engineers on April 30, and a few figures quoted from his address will serve to illustrate the present position.

In 1924, a single national company, Imperial Airways, was established in England. This company, and its predecessors, have carried between them over 70,000 passengers across the Channel, and have flown nearly 4,750,000 miles in all. The total mileage flown per annum increased from 104,000 in 1919 to 943,000 in 1923, the figures for 1924 and 1925 being respectively 936,000 and 826,000. A regular service is maintained to Amsterdam, where it connects with the Swedish line to Malmö, and with the German line to Berlin. A regular service is also maintained to Cologne, connecting with the German line to Munich, and through Paris to Basle and Zurich. Among our overseas dominions, Australia alone has developed air transport seriously. Turning now to other nations, the French have four main services—namely, Paris to London, Paris to Amsterdam, Paris to Constantinople, with a branch to Warsaw, and Toulouse to Dakar. The total mileage flown between 1919 and 1925 was approximately 11,250,000, the figure for 1925 being 2,945,555. The Germans have a comprehensive system of internal lines, with services radiating to Amsterdam, Finland, and Moscow. The mileage flown in the years 1919, 1920, and 1925 are not known, but between 1921 and 1924 the total was 3,272,700, and for 1924 alone 1,151,000. In addition to these countries, a further considerable total is made up from services operated in the United States, Holland, Belgium, Sweden and other countries, and during the last year 14,382,900 miles were flown in all, over organized air routes totalling 31,000 miles in length.

Practically the whole of these services may be said to have been run at a loss, as they are maintained, with one small exception, by the aid of government subsidies. The only case in which a service pays its way without artificial assistance is that from the coast up the Magdalena River to Bogota, in Colombia, the reason in this case being that at times it is the only practicable means of transit. The subsidies paid or voted in 1925 in England, France, and Germany respectively were 137,000*l.*, 57,210,000 francs, and 6,700,000 gold marks, and it is evident that such subsidies cannot be continued indefinitely. The future of commercial air transport is clearly bound up in the possibility of reducing operating costs to an economic level and a discussion of the prospects in this direction constituted one of the most interesting features of Sir Sefton Brancker's address.

Sir Sefton stated that the present total cost of carriage by air is about 5 shillings per ton-mile at 9 miles per hour. In his opinion, such a charge is very high but not impossible for passenger traffic, and it can be accepted as a legitimate charge for carrying first-class mail matter at high speed. It is, however, too high a figure to attract any considerable volume of freight. The principal items of expenditure may be divided in the usual way into

overhead charges and operating costs, the former being subdivided into interest on capital, obsolescence and depreciation, and insurance. Operating costs may be subdivided into maintenance of engines, maintenance of air craft, and fuel.

Dealing with those divisions in order, the most important point associated with interest on capital is the number of machines required to maintain any given service. Sir Sefton Brancker mentioned in the course of his address that a machine should be able to spend 2,000 hours a year in the air on day flying alone, but that owing to the exigencies of present traffic requirements, an average of 1,000 hours per year must be considered good. Figures were given for individual machines of the Imperial Airway fleet during June, 1925, and as an example of actual service it may be mentioned that one machine flew forty-seven times in the month on the London-Paris journey of 225 miles, in addition to several trips on other routes. Another machine covered 900 miles a day on nineteen days included in a period of six weeks. The number of hours flown per year is limited by the necessity of waiting for foreign connections, and a material improvement would result if the services could be extended to avoid this necessity. There is a good prospect of this being achieved, as the difficulties of carrying services beyond the frontiers of Germany are being overcome. There is also a prospect of reducing the initial cost of machines, but up till the present any reductions in production costs have been largely offset by additional equipment tending to increased safety, of which the adoption of three engines per machine is typical.

On the questions of depreciation and obsolescence, Sir Sefton stated that sufficient experience has not been obtained to lay down a fixed rate of depreciation, but that any figure to cover this factor would be very small in comparison with that for obsolescence. The usual figure to cover both factors is taken to be 20 per cent per annum, but this does not satisfactorily cover the constant flow of improvements in design which offer themselves. To emphasize this point, Sir Sefton expressed the opinion that if money were available, most existing machines could with advantage be replaced by all-metal aircraft fitted with air-cooled engines, and provided with the various stability and economy devices which experiments have placed at the disposal of manufacturers.

The third item in overhead charges, that of insurance, has been a heavy drain on operating companies up till the present. Rates are high for two reasons; first, the volume of business is very small, and second, a crash involving no danger to life may damage the machine very badly. Business, however, is increasing, while damage resulting from bad landings and so on has been reduced, with the result that insurance rates, averaging from 20 to 30 per cent per annum in the last six years, have now fallen to 7½ per cent, for three-engined machines, with somewhat higher figures for other types.

Turning next to operating costs, Sir Sefton gave an analysis of the figures for 1925 with the following results. Engine maintenance 44 per cent, aircraft maintenance 20 per cent, fuel 30 per cent, and miscellaneous costs, including flying pay, 6 per cent. Engine maintenance may be divided broadly into the cost of spares and the cost of man-hours required to keep the engine running. The former is high, and may be taken as roughly proportional to that of the engine itself. In the case of water-cooled engines the cost of an engine is about 5*l.* 9*s.* per horse power, but the corresponding figure for air-cooled engines is only 3*l.* 15*s.* Apart from initial cost, it is interesting to note when comparing the two types that in 1925, 20 per cent of the defects leading to the removal of engines from the craft of the Imperial Airways, were due to the water system. Of the other defects leading to the removal of engines, valve breakage or distortion represented 31 per cent, failure of the oil circulation 10 per cent, failure of material 19 per

cent, and other defects 28 per cent. Marked improvements are being effected in the various parts, and the periods between overhauls have been increased from 210 hours in 1924, to 250 hours in the current year.

As regards the maintenance of aircraft, Sir Sefton Brancker expressed the opinion that the standard aircraft in use, a biplane constructed of wood and fabric with interplane struts and wires, probably needs more attention than almost any other type. In the British climate, however, with good housing and maintenance, such machines have flown for eighteen months without overhaul, totalling 2,000 hours and covering 170,000 miles in this period. Future developments would probably be in the direction of an all-metal, thick-wing airplane, without flying wires or struts.

Any large reduction in fuel costs must lie in the development of the heavy-oil engine. Although in this case the weight of the engine is greater than that of a corresponding petrol engine, it is probable, that for long flights this would be outbalanced by the weight of the fuel saved, quite apart from the decreased cost of the latter.

The ultimate success of commercial air services obviously depends on the extent of the confidence of the public in this means of transport, and we may conclude our review of Sir Sefton Brancker's address with some further extracts bearing on this point. Taking the period from May, 1919, to December, 1925, the mileage flown on recognized British transport services was 4,431,000. There were four fatal accidents, in which thirteen passengers were killed, and five passengers injured. There were no fatal accidents in 1925, and it is probable, in view of the recent adoption of additional safety devices, that in the future, the very low average over the last seven years will be still further reduced. The most important additions to the machine from the point of view of safety have been the employment of three engines, already referred to, and various arrangements for reducing the stalling speed. Concurrently with these improvements, methods of navigation have also been improved, and it is not too much to say that the danger of accident may now be regarded as practically negligible.

On the Control of Airplanes at Low Speeds

Aviation, 21 June, 1926.—In the May 31 issue of *Aviation*, W. L. LePage raised again the ever acute question of controlling airplanes at low speeds; at the angles of attack above stalling. In a very interesting review, he explains that control surfaces of present airplanes, in particular the tail surfaces, being nothing but minor aerofoils themselves, stall at the same time as the wing stalls, and leave the pilot in a most disconcerting manner without any means of control. Considering the lateral control, the conditions are still worse. The ailerons may actually cause the burbling of the wing tips set near stalling angle, says Mr. LePage, and instead of righting the airplane, as the pilot naturally expects, they send it into a tail spin. Such being the state of affair with present methods of control, Mr. LePage gives us some suggestions on different unorthodox methods supposed to control the airplane efficiently at the angles of attack way beyond stalling.

Present Methods Discussed

Being for several years connected with practical design and construction of airplanes, I feel that it is only fair toward the present methods of control and toward their designers to put forth some argument for their defense. Let us begin with the longitudinal control, and let us consider in more detail the action of the tail plane in an airplane. Fig. 1 shows an elemental airplane balanced as they used to do it in the early days of aeronautics with the center of gravity located between 40 per cent and 50 per cent of the chord. As the center of pressure on the wing surface at the stalling angle is located around 30 per cent of the chord, the tail plane

has to support a portion of the load, for which purpose it must be set at an angle of attack δ. The continuous lines on the diagram show the streamlines of the air just before the stall. The dotted lines show the same streamlines after the stall. As the lift coefficient of the wing *decreases* after the burbling point is passed, the angle of downwash *must decrease also.*

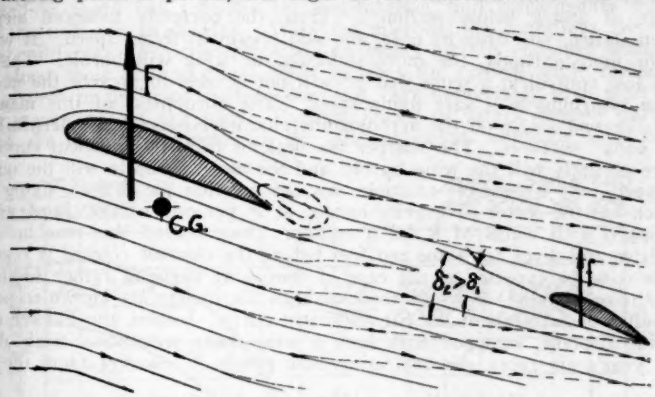

FIG. 1

It is evident from the sketch, that this leads to a sudden and considerable increase of the angle δ. Consequently, the tail plane, which was already on the point of stalling, is caused to burble even more suddenly than the wing does, and the tail drops down, thus aggravating the stall. This has actually happened in case of Farman pusher biplanes of 1912 which, when stalled, used to drop their tails in very much the same manner as the present

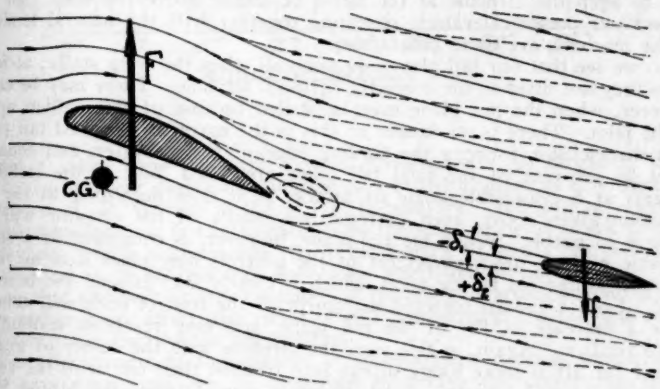

FIG. 2

day airplane drops its nose. This type of airplane clearly possesses all the undesirable features pointed in Mr. LePage's discussion.

Let us consider now Fig. 2, showing the airplane balanced according to present day requirements, in such a way, that the center of gravity is located ahead of the center of pressue. In this case evidently the tail

plane will be subjected to a down load, and its angle of attack δ will be negative. As the wings of this airplane burble, and the angle of downwash is, therefore, diminished, the angle δ will be increased algebraically and probably will be changed from the negative to the positive value. This, of course, will cause the "tail to rise, thus bringing the airplane again to an angle of attack below stalling". Thus, the correctly balanced airplane, when stalled, will drop its nose, and will regain its flying speed. It will do it the more abruptly, the more suddenly the wing will burble. The pilot will lose control in a sense that he will not be able to prevent the machine from returning to a safe flying speed. The abruptness of this maneuver will "depend solely on the aerodynamic characteristics of the aerofoil used for wing" surfaces. The sharper the peak of the lift coefficient curve, the more abruptly will the wing burble, and the more abruptly will the nose be dropped. As a concrete example, we can mention the *HS-2L* flying boat, which has the center of gravity located at 25 per cent of the chord, and "is equipped with wings of R.A.F.6 section. Once stalled, this machine drops its bow, and dives for some 200 feet before the elevator control is regained. This is to be expected in the case of thin wing burbling rather suddenly." On the other hand, wings of thick or high lift variety are known to possess a well rounded peak of the lift coefficient curve. Indeed, the Fokker three-engine airplane, equipped with such a wing made sensational trials during last year's air races, demonstrating how gently it recovers from the stall.

Holds Normal Elevator Satisfactory

Thus we see that the control surfaces of the properly balanced airplane do not behave during the stall in such an atrocious manner as Mr. LePage indicates, and in reality they are quite satisfactory. It is true that the pilot loses his control, but this only to the extent of not being able to keep the airplane at an angle of attack above stalling. In practical flying we are really not interested in this portion of the control, and are quite satisfied, if the controls allow us to regain the normal flying speed. As a matter of fact, in the case of the amateur pilot, it is of some advantage *not to be able* to keep the airplane at the angle of attack above the stall. In this respect our present elevators, operating together with the natural tendency of the machine, are quite satisfactory.

So we see that our tail planes do not stall when the wing stalls; at least, when they are fitted to the correctly balanced airplane. There may be cases, however, when the tail plane may be stalled because of the sudden action of the pilot. There is no danger of this in the correctly designed tail plane with the elevator forming the trailing edge of the stabilizer, and equal to about 30 per cent of the total tail plane area. As long as the stabilizer remains at a reasonable angle of attack, as it does according to the explanation given above, even extreme movements of the elevator will not cause it to burble. When the tail plane, however, is composed of a single movable surface, quick movement of the controls may place it at an angle of some 30 degrees to the wind, which is clearly way beyond the burbling point. Such a sudden forward movement of the control stick will actually cause a decrease of lift of the tail plane, and may result in stalling the entire airplane. Again, in this case, the airplane with the center of gravity located far aft is more likely to run into trouble, than one with the center of gravity located forward. Such elevators were fitted to the Moran Saulnier airplanes of 1914, and probably are responsible for the very large number of tail spinning accidents observed, even with experienced pilots, on these machines. Unfortunately even now we see this type of tail plane often fitted to gliders, where it is least suitable, considering that gliders always fly at angles of attack very near to the stalling.

Lateral Control

Let us consider now the control of our airplane in roll after the stall. As one wing drops down, its downward velocity combined with its forward

velocity causes increase of the angle of attack. At the angles beyond stalling, the increase of the angle of attack leads to the *decrease* of the lift, and the angular motion of the airplane continues,—the phenomenon generally known as *autorotation*. It is evident that, were our airplane equipped with wing warp for lateral control, the operation of this warp at the stalling angle will provoke the autorotation, and consequently would cause the tail spin to develop. With the ailerons, the conditions are fortunately different. Experiments made on model airfoils equipped with the flaps along their trailing edges show us that the critical angle measured with respect to the fixed surface does not vary appreciably even with extreme movements of the flaps. Even at angles of attack beyond stalling, putting the flap down increases the lift somewhat, although very little.

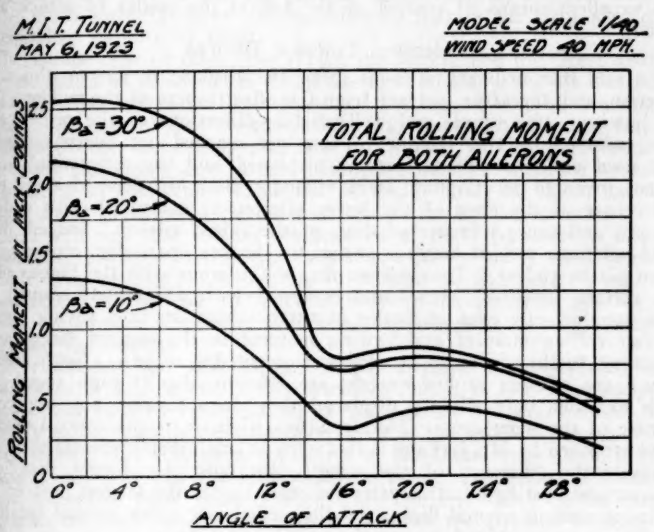

FIG. 3

Figure 3, taken from the book, *Simple Aerodynamics*, by Monteith, shows the rolling moment due to the ailerons of a model airplane as determined by Professor E. P. Warner in the M.I.T. Laboratory. We will observe that the ailerons decrease in effectiveness from the small angle of attack to about 16 degrees, which is presumably the critical angle of attack for this model but even up to 28 degrees they have some effect and do not reverse. Thus we see that although ordinary ailerons at the angle of attack beyond stalling have rather weak effect, the effect is still present, and the ailerons cannot be blamed for starting the autorotation.

The effectiveness of the ailerons at stalling angle depends somewhat on their plan form, and can be improved by giving the center line of the aileron hinges an angle "screw" of some 15 degrees, as was shown by wind tunnel experiments made at McCook Field, and very well explained by Dr. Munk.

EFFECT OF RUDDER

The aileron put down has more drag than the aileron put up, and, therefore, the operation of ordinary straight ailerons causes the airplane to yaw in the direction of the lowered aileron, as Mr. LePage justly observes. The

rudder of an airplane should be, and usually is, designed to be powerful enough to overcome this tendency. Indeed, in most of the present-day airplanes it is quite possible to reverse the direction of the tail spin by quick action of the rudder. We will remember that effectiveness of the rudder and fin diminishes only as the flying speed diminishes, but is not affected in the least degree by the burbling of the wing. As a matter of fact, quicker yaw can be produced by rudder at low speed than at high, because at low speed the damping is much weaker.

Quick action of the rudder causes the machine to yaw, and makes one wing travel through the air faster than the other. The wing moving faster acquires more lift and rises. This effect of the rudder—roll due to yaw—is more pronounced, the lower is the flying speed, and furnishes the pilot with excellent means of control of the roll at the angles of attack above stalling.

Lateral Control Devices

We said that ordinary ailerons cause the airplane to yaw in the wrong direction, and, therefore, detract from the effectiveness of the rudder. There are, however, two simple and well-tried modifications of the ordinary ailerons, which cure this trouble. These are washed out ailerons, such as were used on most of the German airplanes, and the differential aileron control invented by Captian DeHavilland. Both of these devices result in decrease of the drag of the lower aileron, as compared with ordinary ailerons, and cause increase of drag of the raised aileron. Indeed, differential ailerons act in way as wing tip brakes, partially replacing the action of the rudder. Thus we see that the ailerons with the hinges placed at a certain angle of "scew" and equipped with differential control, will work satisfactorily even at angles of attack above stalling, giving, as they do, fair rolling moment and yawing moment in the correct direction, i.e. provoking further increase of rolling moment due to yaw. Such ailerons, being quite efficient at low speeds, are efficient also at high speed, inasmuch as when only slightly displaced they do not cause any appreciable increase of the wing drag. The drawback to most of the control arrangements proposed by Mr. LePage is that even at small displacements they affect adversely the efficiency of the wing. We must not forget that, while the controls must be effective after the stall, by far the largest part of their service is used in normal flight, and their efficiency under normal conditions should not be sacrificed too much.

The Tailless Airplane Combines Stability with Flexibility

Christian Science Monitor, 7 June, 1926.—Aeronautical engineering for years has been one of the most fruitful of the engineering arts when it comes to invention. New ideas and developments are materializing day by day and, as a result, there is perhaps a tendency to overlook unfoldments which in another less productive field would receive considerable attention.

Nevertheless, every now and then there is an invention or development of such startling interest that the entire aeronautical field is set alive with discussion. Such is the case at the moment with regard to the tailless airplane which has been developed in England by Captain G. T. R. Hill.

The tailless airplane is really nothing new. It resembles an ordinary airplane with the exception that, when viewed from above, the wings, which in an ordinary airplane are straight, in the Hill tailless airplane slope backward in the form of a somewhat blunt arrow and there is no tail.

The old-timers in the aeronautical world will remember with some vividness the early Dunne airplane of 1911 and thereabouts. The Dunne machine was a biplane designed as a seaplane. The wings were swept far back and there was no tail as in modern airplanes. The machine flew moderately well, but very poorly compared with modern airplanes.

The question arises, however, as to why it is necessary to build airplanes of such a curious shape compared with our recent ideas of what an airplane should look like. And it is just there, in that very question, that the real significance of the Hill production rests.

Flexibility Factor

In the early days of flying there were, among aeronautical engineers, two very distinct schools of thought. Both had a common object in view, since all were striving toward the attainment of stable, safe, controllable flight. However, realizing the difficulties of controlling an airplane, one school was of the opinion that the solution of flight was to be obtained in the production of an airplane which was so stable that it could not be upset, while the reverse was the general opinion that an airplane should be not so much stable as controllable, believing that in the pilot should rest the complete stability of flight.

The Dunne type of plane, the Weiss, the Etrich, and the Geest machines were examples of development from the first school, while all the modern planes of today are direct descendants of the second way of thinking. It is, therefore, obvious that the first school was somewhat unsound, for, with airplanes of the pioneer days capable of a very limited performance in both speed and climb, any further hampering of these qualities by making the machine so completely stable that it could barely be flown out of its straight flight path into a circle, would be extremely detrimental.

The result was that further development of flight possibilities was very considerably hindered in this type of plane. On the other hand, while the unstable type of plane was extremely difficult to fly, nevertheless, there was sufficient latitude for the pilot to improve his ability in piloting, and, thereby, understand the exact nature of the problems to be overcome in perfecting the machine.

The result has been that the present-day airplane is not perfectly stable, as in the early Dunne and Weiss machines, but it is also completely controllable and maneuverable, having a wide range of performance, which the early stable machines did not have even in the smallest degree.

Yet, despite this very apparent defect of the Dunne type plane, it cannot be said in any way that the Hill tailless airplane, resembling, as it does the Dunne, possesses these same deficiencies. The real facts of the case are that, with the very considerable extent to which the airplane is being used in commercial and individual private spheres, the two questions of safety in flight and ease in piloting become of even more immediate importance.

Research Progress

A very considerable amount of money and time is being spent both in America and in Europe on this subject. The investigation has centered itself around the problem of obtaining adequate and complete control at slow speeds of flight, a feature which is not very well taken care of in modern airplanes. The reasons for this are twofold.

In the first place, since the control of an airplane is obtained as a result of the action of the moving air upon specially arranged flaps called control surfaces, it stands to reason that the slower the airplane is traveling the smaller will be the efficacy of these flaps to control the plane. Secondly, one peculiarity of surfaces, whether wings or control flaps, is that while the lift force in the case of wings, and control force in the case of flaps increases as the angle of the surface to the wind increases, there comes a time when, in spite of further increases in angle, the force falls off rapidly.

Such is called the stalling condition and it is this feature of every airplane which is the cause of the most trouble, for the slower an airplane is traveling, the closer will be the approach of the stalling condition and the nearer the danger of a sudden falling off in the ability to provide adequate

control. And, since this condition arises always when a landing is being made, the dangers of a stalled, uncontrolled landing become paramount.

It is just this problem which has occupied the thoughts of Captain Hill for the last three years. As a result of a close study of the problem, he laid down certain principles which he has adopted in the development of his tailless machine.

Since the sole function of the tail of an airplane is to provide for fore and aft control of the machine, Captain Hill abolished the tail plane and substituted entirely independent control surfaces which are not subjected to the particular attitude of the machine. These will not, therefore, be operating in the stalled attitude when the airplane is stalled, such as in landing.

Controllability

The Hill machine is a small monoplane, the wing of which is swept back on each side of the little nacelle or body. At the wing tips, on each side, is a control surface capable of being moved about a lateral shaft from the pilot's cockpit in the nacelle. These control surfaces are capable of controlling the airplane regardless of the particular attitude of the whole machine, and while they are still, of course, dependent upon the forward speed of the airplane for their efficacy, they are immune from any stalled condition in which the wings of the machine may be.

Thus, the question of control at and around the stalled condition is partially, if not completely, solved. It is also interesting to emphasize that the Hill plane, though similar in many repects to the early inherently stable machines of a similar type, is controllable and maneuverable under practically all conditions.

The machine is equipped with a small Bristol Cherub engine such as is used in the tiny light planes which have aroused such wide interest throughout the world. Test flights have been carried out and a maximum speed of 75 miles an hour obtained, while, during landing, it has been found possible to stall the airplane and still maintain complete control up to an angle as high as 45 degrees, which, remembering that a normal airplane usually goes out of control at angles above about 15 degrees, is an extremely significant performance.

As regards the future of the experiments, it is proposed to develop the ideas involved in the Pterodactyl, the name which Captain Hill has given his tailless airplane, owing, presumably, to the finger-like controls which it possesses at its wing tips, into a larger machine capable of carrying several people instead of simply two, as is the case in the present machine.

Whether the details of design will become complicated in the case of a large airplane is a point of considerable interest, but the great encouragement in the success of the Pterodactyl rests in the fact that, while normal design is moving comparatively slowly through conventionality, Captain Hill's ideas represent something entirely new and have been proved to be sound and successful.

ENGINEERING

Pennsylvania Tug "Wicomico" First Diesel Electric Vessel to Arrive at Hampton Roads

Westinghouse News Service.—The first Diesel-Electric vessel to be assigned to the port of Norfolk and the Virginia capes arrived at the Pennsylvania Railroad dock recently to enter its permanent services here. The tug which, except for the main Diesel oil engines, is operated throughout by electricity will run between Cape Charles and Norfolk.

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While the use of the Diesel-Electric tug boat is a departure from established tug boat practice in the Norfolk district, the application of the prin-

ciple to Marine propulsion has been well tried out by the Pennsylvania Railroad. The *Wicomico* is the fourth vessel of its kind built for the company, and with a fifth now being built, the Pennsylvania Railroad will rank among the leading operators in the United States, of Diesel-Electric vessels. The *Wicomico* is measuring 122 feet over all with a beam of twenty-six feet and a draft of twelve feet. The boat is equipped with two Winton-Diesel engines of a total of 750 horse power driving Westinghouse direct current generators of a total of 500 kw. Of the electrical energy developed the necessary power is diverted to the main driving Westinghouse motor which is rated at a total of 575 shaft horse power. In addition to the main power plant, the tug is equipped with a powerful motor generator unit for lighting service.

The auxiliaries on the *Wicomico* are electrically operated thus making the boat in the truest sense a "ship electric." The boat is ordinarily controlled by the pilot, all maneuvering being done directly by the pilot through control pedestals corresponding to the ordinary ships engine telegraph. This system of control eliminates all signals between pilot and engineer, with a consequent possibility of confusion in signals and loss of time. The Westinghouse variable voltage control is used throughout. The *Wicomico*, however, has two distinct control stations, one in the pilot house already referred to, while the other is in the engine room for emergency purposes. The systems are distinct and are interlocked so that either one or the other is in circuit.

All heating, cooking, and refrigerating on the tugboat is being done electrically constituting a decided improvement in such practices as compared with older steam-driven tug boats. For fire fighting purposes the *Wicomico* is equipped with a powerful motor driven pump capable of serving two fire monitors, one on top of the pilot house and the other is on the forward deck.

The switch board is so arranged that the power of the main generators, if desired, can be diverted to the fire pump motor, while the other main generator serves the propeller motor in case of such an emergency. This of course provides exceptional flexibility of the Diesel-Electric drive which, even may be operated with one engine unit completely shut down and half power applied to the system by the remaining generator unit.

Improving Gray Cast Iron with Nickel

The Development and Research Department, International Nickel Company.—Requirements for gray iron castings are continually becoming more exacting and severe. Both engineer and manufacturer are demanding better quality and substantial improvements in many physical features, such as hardness, strength, and machinability.

These demands are frequently of a conflicting nature and present a real problem to the foundry, the solution of which by the usual means available is often not possible. In order to successfully meet these problems many foundries are using nickel additions in their iron.

It is the purpose of this pamphlet to describe briefly the various useful effects of nickel additions to gray iron and to suggest ways in which they can be and are used today by iron foundries in meeting many of their problems. They are not recommended as panacea for all ills but they are very efficacious in solving many of the most difficult and serious problems foundries have to meet today.

The general statements made below refer more particularly to ordinary cupola iron. Cast iron is a very complex material and its properties are influenced considerably by many factors—composition, cupola practice, brands of pig used, molding practice, etc. Proper allowance must be made

in applying these general statements, therefore, to the particular and varied materials and conditions of different foundries.

Uses of Nickel in Solving Foundry Problems

(1) Refining Grain

Nickel refines the grain or texture of gray iron, and small additions are in general most effective for this purpose; viz., from 0.10 per cent to 1 per cent. Large amounts of nickel—from 3 per cent to 5 per cent—may coarsen the grain if the silicon content is too high for the amount of nickel added.

(2) Controlling or Reducing Chill and Eliminating Hard Spots, Chilled Corners, Etc.

Nickel, like silicon, assists graphite formation and carbide decomposition. It, therefore, *acts effectively to reduce chill and to eliminate hard carbide spots, chilled edges and mottled areas.* Roughly speaking, 1 per cent of nickel is equal to ½ per cent of silicon in this respect.

There is a limit, however, beyond which silicon is no longer effective in reducing chill, about 3 per cent. The effect of nickel is progressive and extends beyond that of silicon. Small and quickly cooled sections of iron, which cannot be rendered completely gray by the use of 3 per cent of silicon can be cast gray by the use of nickel.

When nickel is added to iron, less silicon is necessary in order to keep castings completely gray and machinable. This is shown clearly in Fig. 1, in which are given the percentages of nickel and silicon required to render castings of different section completely gray and machinable.

The reduction of chilling power of an iron and consequent elimination from castings of hard and brittle spots can, of course, be accomplished by the use of higher silicon, and more cheaply than by the use of nickel. But *the silicon method entails progressive impairment of physical properties,* more open grain, greater tendency to porosity and internal shrinkage, decreased hardness and strength, whereas *the nickel method secures progressive improvement in these properties,* as will be shown below.

(3) Improving Machinability

Th machinability of gray iron depends primarily on its freedom from chilled areas, corners and edges, and from carbide spots which quickly dull the tool. Since nickel reduces chilling power and acts powerfully to eliminate free carbides it definitely improves the machinability of castings. The amounts of nickel to be used for this purpose are essentially those shown in Fig. 1, varying from ½ per cent to 4 per cent, depending on composition, section of casting, etc.

Stepped cylinders were cast from the same 1.40 per cent silicon iron, making successive additions of nickel in separate hand ladles. Fracture and hardness of the different sections of the cylinder are given in the table.

Nickel Per cent	Brinell Hardness 1 inch section	¼ inch section	⅛ inch section
0	234	255 gray	4 inch white iron at end
½	244	255 gray	2 inch white iron at end
1	248	255 gray	⅜ inch white iron at end
2	255	269 gray	1/32 inch white iron at end
3	269	269 gray	free from white iron

The cylinders were placed in a lathe and machined on the outside face, starting at the thick end. A 1/16" cut was taken, the feed and speed remaining the same in each case.

The cylinder of plain iron machined with difficulty, requiring regrinding of the tool three times before the chilled ⅛" section was reached. The cylinder with ½ per cent nickel was machined to the ⅛" section before dulling, and after regrinding, machined up to the chilled section. The cylinder with 1 per cent nickel was machined to the chilled iron without regrinding. The cylinder with 2 per cent nickel was machined the entire length without difficulty. The tool was not reground for the cylinder with 3 per cent nickel which was also machined its entire length without difficulty.

Thus the nickel-iron cylinders machined more readily than the plain iron one, although they were actually harder than the latter.

Machinability alone can be improved also by the use of higher silicon, of course, and more cheaply, but with attendant and progressive impairment of physical properties. When these may not be sacrificed, nickel should be used; it will improve machinability and at the same time progressively improve physical properties.

One manufacturer of motor cars uses from 1 to 1½ per cent nickel in thin wall pistons of 2.50 per cent to 2.75 per cent silicon iron in order to secure greater machining production without sacrifice of physical properties: hardness and wear-resistance.

(4) Controlling Combined Carbon

Every foundryman knows that the combined carbon content of his castings is a controlling factor of their quality, strength and machinability. Many of his mixing operations are designed for no other purpose than to control combined carbon. When it is too great, his castings are hard and unmachinable; when too low, they are too soft, open in grain and often porous.

Nickel, like silicon, exercises a marked influence in reducing the combined carbon content of a casting to the free carbide point, about 0.80 per cent or just below. Unlike silicon, however, it acts only mildly to reduce it beyond this point. Thus, although nickel is very effective in keeping iron gray, it does not act powerfully, as does silicon, to open the grain and soften it when present in excess. This is shown in the following Table I:

Table I

Comparison of the Effect of Silicon and of Nickel on Combined Carbon Content of a 1¼" Cast Arbitration Bar

	In a 3.60% carbon iron					
	Increase of nickel (←)			Increase of silicon, (→)		
Silicon	1.40%	1.40%	1.40%	1.40%	2.03%	2.56%
Nickel	3.88	1.23	0.67	0.00	0.00	0.00
Combined Carbon	0.56	0.62	0.76	0.72	0.59	0.45

	In a 3.15% carbon iron			
	Increase of nickel (←)		Increase of silicon (→)	
Silicon	1.25%	1.25%	1.25%	2.00%
Nickel	4.00	1.00	0.00	0.00
Combined Carbon	0.74	0.80	0.83	0.46

(5) Increasing Hardness

The addition of nickel to iron in amounts from 0.5 per cent to 10 per cent will progressively harden it, but in a manner so distinctly different from that familiar to the foundryman that it deserves explanation.

A bar ½" x ¾" was sand cast of 1.40 per cent silicon iron with different nickel additions:

	Brinell Hardness	Fracture
With no addition	174	gray, machinable
With 0.67% nickel	217	gray, machinable
With 4.59% nickel	269	gray, machinable
With 9.00% nickel	350	gray, only difficultly machinable

The bar with 4.59 per cent nickel was readily machinable in spite of its high Brinell hardness.

Gray cast iron consists structurally of a matrix of iron (combined with some carbon) within which are soft graphite flakes and hard, free carbide particles in the case of hard irons. Its hardness depends not only on the intrinsic hardness of that matrix, but upon the amounts and distribution of the graphite and carbides as well. When a soft iron is desired the foundryman uses a higher silicon content, and thereby increases the amount of soft graphite and eliminates the hard carbides. When he wishes to secure in-

PERCENTAGES OF SILICON AND NICKEL REQUIRED TO RENDER CASTINGS OF DIFFERENT SECTIONS COMPLETELY GRAY AND MACHINABLE

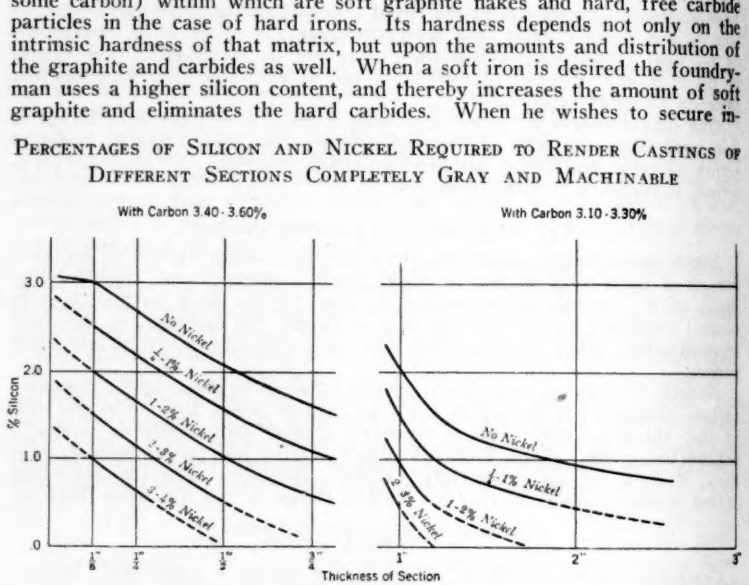

FIG. 1

creased hardness in his castings, however, he lowers his silicon content and secures it by diminishing the amount of soft graphite flakes and increasing the amount of hard carbides. The matrix of the iron (pearlite) remains subtantially the same in either case and relatively soft intrinsically.

The distinctive feature of hardening gray iron by nickel is that this is accomplished by a progressive and uniform hardening of the iron matrix (producing sorbite) instead of through increase of the amount of hard carbides. It is evident, therefore, that nickel plays an unusual and a double rôle in gray iron; a very contradictory one. It definitely and substantially hardens it through its effect on the matrix, but it "grays" it and renders iron more free from carbides at the same time and in this sense "softens" it as far as machining is concerned.

This double effect is well illustrated in the experiences with stepped cylinders described under (3).

(6) OBTAINING MAXIMUM MACHINABLE HARDNESS

The peculiar and contradictory effect of nickel just described can be utilized effectively in a very practical way; namely, *to secure readily machinable castings with hardness values of 200-250 Brinell,* far in excess of

those obtainable by the ordinary means. This may be done in heavy as well as light sections.

When the foundryman attempts to increase the hardness of his castings by decreasing silicon or carbon or by raising sulfur, he quickly reaches a limit by reason of the fact that the thin sections, corners or edges of his castings chill and become unmachinable. It is impossible to secure by such means alone hardness values substantially in excess of from 150-200, depending on composition and thickness of section. He is attempting to increase the hardness of his castings by increasing the amount of hard free carbides, with the inevitable consequence of impairing machinability. Yet the matrix of the iron remains soft, and its real hardness low.

By using nickel it is possible to develop the full hardness of the matrix of the iron without the formation of carbide hard spots and attendant machining difficulty. Properly made nickel-bearing iron castings will, therefore, machine as readily at 250 Brinell as ordinary iron castings at 200 Brinell, due to the fact that the former are completely free from carbide spots and areas which are responsible for dulling the tool.

A manufacturer of special machine tools uses iron cams of sections from 1" to 2½". When made of iron with a 30 per cent steel addition to give 1.50 per cent silicon and 3.40 per cent total carbon, these cams averaged 170 Brinell hardness and gave trouble at times in machining due to chilled edges. Using 35 per cent steel to reduce the silicon to about 1.40 per cent together with 3 per cent nickel (together with 1 per cent Chromium) the hardness of the cams averaged 240 and no difficulty was experienced with chilled edges. Naturally, these cams showed a considerable improvement in wear-resistance in service.

In using nickel in different compositions of iron for this purpose one fundamental fact should be remembered. The maximum effect of nickel additions in increasing "machinable hardness" is not attained except when the combined carbon content of the casting is up close to, but not greater than, about 0.80 per cent; in other words, when the casting is just barely gray and machinable. When by reason of high silicon or total carbon content the combined carbon is low, the effect of nickel in increasing hardness is less pronounced.

Therefore, in securing maximum machinable hardness with nickel it is usually desirable to make other changes as well in the composition of the iron, designed to keep the combined carbon up to this figure. This can be done, of course, very nicely by reducing the silicon content. This will in general be necessary when adding nickel in order to compensate for the "graying" effect of the nickel addition, Fig. 1. The same effect can be secured also by reduction of total carbon.

* * * * * * *

Use and Effect of Chromium:

There is another method of raising and adjusting combined carbon content and that is by the proper use of chromium. Experience has shown that in certain cases better results may be obtained by the use of combinations of nickel and chromium than by the use of nickel alone. The effect of chromium on iron is very different from that of nickel, but when properly used together they may supplement each other very usefully.

Chromium even in small amounts, from 0.10 per cent to 0.50 per cent, refines the grain of iron and increases markedly its chilling power. By the use of chromium, therefore, the combined carbon of castings may readily be raised, just as by reducing silicon or carbon content. In heavy sections, particularly, chromium is very effective in holding combined carbon us and close to that value—about 0.80 per cent—noted above as most favorable for nickel.

In addition, certain combinations of nickel and chromium have a greater intrinsic hardening and strengthening effect on the iron matrix than either element alone. This is true particularly of combinations in the ratio of two or three parts of nickel to one part of chromium, which have proved so effective in the nickel-chromium steels.

In the following paragraphs the use of chromium in conjunction with nickel additions will be suggested wherever experience has indicated its value. One word of caution may be given. When chromium is present in excessive amounts, it produces chromium-carbide hard spots which quickly dull a machine tool and render castings unmachinable, particularly in thin sections. Therefore, in light sections it is advisable to use nickel alone in securing the maximum hardness, and thus to run no risk of chilling corners and edges by the use of chromium. In heavy sections, however, chromium additions are useful and may be economical in bringing the hardness up to the desired point.

Fortunately, nickel restrains the chilling action of chromium and by its use the beneficial effects of chromium may be utilized without its disadvantages. Usually it is desirable to add nickel and chromium in the ratio of three to one respectively in order to balance their opposing influence on chill.

In choosing the proper amounts of nickel or of nickel and chromium to secure maximum machinable hardness in different compositions of iron and in different sections of castings, Table II will serve as a useful guide. The increase in hardness from 200 to 250 is roughly progressive with increasing amounts of nickel from 1 per cent to 5 per cent (or equivalent amounts of nickel and chromium).

* * * * * * *

TABLE II

*Amounts of Nickel and of Chromium Recommended in Order to Secure Maximum Machinable Hardness and Strength in Iron Castings of Different Sections**

	Light Sections ¼″ to ½″ thick		Medium Sections ½″ to 1″ thick		Heavy Sections 1″ to 3″ thick	
	Nickel	Chromium	Nickel	Chromium	Nickel	Chromium
1.00-1.50% Si. iron	.50-3.00		.75-3.00	.00-.30	.75-3.00	.20-0.60
1.50-2.00% Si. iron	.50-2.0	.00-.30	.75-2.0	.20-.40	.75-3.00	.40-1.0
2.00-2.50% Si. iron	.50-1.50	.00-.40	.75-1.50	.30-.60	.75-3.00	.50-1.1
2.50-3.00% Si. iron	.50-1.25	.20-.50	.75-1.25	.40-.75	.75-3.00	.60-1.25

* These recommendations are based on a low sulfur Bessemer iron with 3.30 per cent to 3.50 per cent total carbon.

(7) EQUALIZING HARDNESS IN DIFFERENT PARTS OF A CASTING

It is well known that parts of a gray iron casting which cool quickly are apt to be harder than those which retain their heat longer and cool slowly. Often a quite considerable and undesirable difference in hardness may thus result in different portions of a casting.

Nickel can be used effectively to equalize the hardness in different sections or portions of a casting.

This very useful effect of nickel is well illustrated by the experience of a motor truck manufacturer in connection with cylinder blocks. He tested the hardness on the bore of the cylinder at different points along the axis using cylinders both of plain and of nickel-bearing iron. The results of his tests are shown in fig. 2.

It is evident that the hardness of the alloy iron cylinder is not only much more uniform over different sections but is at all points considerably higher than that of the plain iron cylinder. This uniformity of hardness is of

importance, it may be mentioned, in preserving a uniform finish machined size of bore from top to bottom.

Normally a casting, having both light and heavy section, may be soft in the heavy sections and white or mottled, hard and unmachinable in the light sections. If the silicon is lowered to harden the heavy section, the light one becomes harder and unmachinable; if the silicon is raised to render the light section machinable, the heavy section becomes too soft and open in grain.

Since nickel both hardens iron and reduces chill simultaneously, it is possible with it to harden the heavy section and render the light section more machinable at the same time, using additions of from 1 per cent to 3 per cent. In heavier sections chromium may advantageously be used up to 0.50 per cent, when required in high silicon irons.

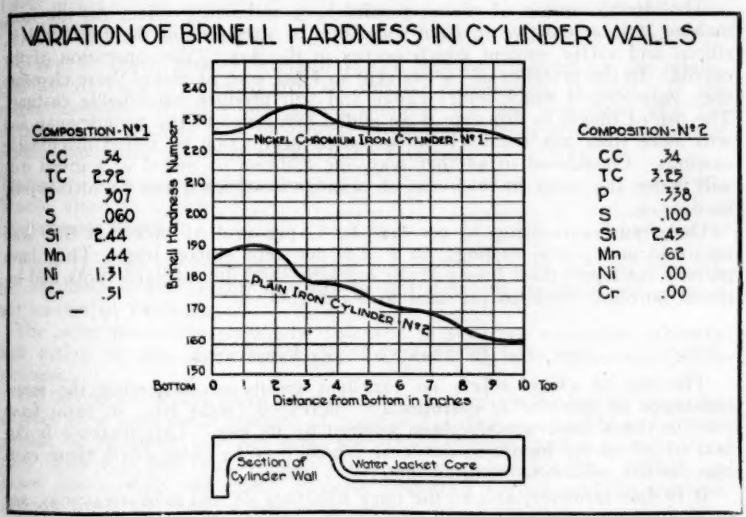

FIG 2

Thus the presence of nickel stabilizes both the hardness and the machinability of iron at one and the same time. This is well illustrated by the stepped cylinder tests under (3).

How to Calculate Amount of Nickel Required for Hardness Equalization

Suppose a casting is to be made of a complicated section. Assume that the thicker portions should be made with about a 1.40 per cent silicon iron in order to secure fine grain and good strength and hardness. However there are thin sections, also, which require 2.25 per cent silicon in order to keep them machinable and tough. If this amount of silicon is used, however, the heavy section will be open in grain and too soft and weak. The equivalent of (2.25 per cent—1.40 per cent silicon) = 0.85 per cent silicon is 2 x .85 = 1.70 per cent nickel as far as effect on chill is concerned. If this amount of nickel is added to the 1.40 per cent silicon iron, the light section has received its silicon equivalent and will be gray and machinable, yet the heavy section will be even harder and stronger than with plain 1.40 per cent silicon iron.

Nickel increases the core hardness of iron castings and in consequence it is possible to obtain harder surfaces with it after machining off ⅛" to ¼" skin.

(8) Stabilizing Machinability

Nickel can be used effectively to stabilize the machinability of gray iron castings in day by day production.

In spite of most careful supervision the production from a cupola varies in composition from day to day and hence in tendency to chill and to retain hard unmachinable spots in quickly cooled sections. It is safe to say that cupola production cannot be kept within a smaller margin of variation than 30 points of silicon. As a consequence the castings may be too soft or open when the silicon is at the high point, but hard and unmachinable when the silicon runs 30 points lower.

The double action of nickel results in a stabilizing effect on the iron, making it less sensitive to hard spots due to variation in the total carbon, silicon and sulfur content which occurs in the day to day operation of the cupola. In the presence of ¼ per cent to 1 per cent of nickel these elements may vary over a much wider range and still produce machinable castings. The use of nickel in this way is an added assurance to the foundryman and will more than pay for itself in increased production of sound machinable castings. Considered in another way, the addition of nickel to a given iron will widen the range in thickness of castings in which it can be successfully used.

One foundry is using ¼ per cent to ½ per cent of nickel in thin wall manifold and piston castings, in a 2.40 per cent silicon iron. They have thereby cut down their losses in the machine shop due to hard spots and internal porosity from 20 per cent to 6 per cent.

(9) Increasing Wear-Resistance

The use of nickel offers an excellent means of increasing the wear-resistance of machinable castings and increased "wear life" in ratio from 2 to 10 times have actually been secured by its use. This increase is due first of all to the increased hardness which may be obtained in these castings, as has been demonstrated under (5) above.

It is due, however, also to the finer structure of nickel-iron castings, and to their freedom from hard and brittle carbide particles. Thus under ordinary circumstances, such as in piston and cylinder service, these hard and brittle carbides are dislodged by friction and serve as abrasive, to score and wear the sliding surfaces. Iron of which the matrix has been hardened up to 200-250 Brinell by the use of nickel is free from these particles, takes a fine high polish in service and resists wear considerably better than softer iron of less uniform structure.

The amounts of nickel (in some cases used in conjunction with some chromium) to be used in improving wear-resistance depend on the composition of the iron and the shape and section of casting in question; they are indicated in Table II, and are the same as those recommended for developing maximum "machinable hardness."

One manufacturer of motor cars uses 2 per cent of nickel in his 1.75 per cent silicon cylinder iron. By this means the Brinell hardness of the cylinders is increased from 150 to 200 and the cylinders in test service showed after 50,000 miles only as much wear as the ordinary plain iron cylinders would show after 25,000 miles. This improvement in wear-resistance is probably not alone due to the increased hardness, but also the finer structure obtained, in consequence of which the cylinder bore takes on a fine high polish or glaze in service.

(10) Increasing Strength

Nickel increases the strength of gray iron: in transverse, tension and compression. The increases due to the simple addition of from ½ per cent to 5 per cent nickel vary from 10 per cent to 50 per cent, and depend upon the composition of the iron and other factors.

Thus, arbitration bars of a 1.40 per cent silicon iron showed the following properties:

Table III

Effect of Nickel on Strength of Iron

	Transverse Strength	Tensile Strength
Without nickel	3390 lbs.	21,900 psi
0.67% nickel	4100	32,600
1.23% nickel	4510	31,900
3.88 nickel	4290	33,300

However, much greater strength values may be obtained by the intelligent use of nickel, provided iron of suitable composition is used. If the proper amounts of alloy are added, suitable for the iron used and the section of the casting, it is in general possible to secure strength values in readily machinable castings equal to the following:

Transverse strength (arbitration bar)	5,000 lbs
Tensile strength	40,000 ♆
Compressive strength	110,000 ♆

Table II gives recommendations for the use of alloy to increase strength and hardness in machinable castings to suit different compositions of iron and section of castings.

The same procedure should be followed in securing maximum strength with nickel as was described under (6) covering maximum machinable hardness.

The action of nickel alone in increasing strength is dependent upon the presence of a reasonable amount of combined carbon, preferably as high as possible up to about 0.80 per cent, the eutectoid ratio, and not lower certainly than 0.50 per cent, if substantial increases are sought. Nickel, as shown above, does not itself increase combined carbon and in castings carrying small amounts of combined carbon, small amounts of nickel produce only small strength increases.

Therefore, in iron compositions which, by reason of high silicon or total carbon content usually show a low combined carbon and less than the limits cited, some other means should be taken at the same time to raise this combined carbon, and thus to secure the maximum beneficial effect from the nickel addition.

An excellent means is the simultaneous addition of chromium. This is one reason why, for many compositions of iron, nickel and chromium additions together and in the proper ratio, will produce strength results superior to either of these alone. In this case the two elements function differently but in a supplementary manner.

Another method of raising combined carbon is the simultaneous reduction of silicon or of carbon content, allowing the nickel to substitute for silicon or carbon in eliminating excess carbide. In particular reduction of total carbon content to about 3 per cent (or even less where possible), together with the use of nickel, is a very effective method of securing high strength in machinable casting. By this method cheaper or higher sulfur irons or scrap may often be used partly offsetting the cost of the nickel.

* * * * * * *

CASTINGS FOR WHICH NICKEL AND NICKEL-CHROMIUM ADDITIONS ARE RECOMMENDED AND ARE BEING SUCCESSFULLY USED

Automobile Cylinders and Cylinder Sleeves:

Increased hardness and improved wearing properties, combined with machinability, are the governing factors. Reduce the silicon to 1.75 per cent to 1.90 per cent and add 1 per cent to 2 per cent nickel. If the silicon is around 2.25 per cent and cannot be changed add 0.75 per cent to 1.25 per cent nickel with 0.30 per cent to 0.40 per cent chromium.

Bushings:

A wear-resistant, fine grain and readily machinable iron is required for machine bushings. Use slightly lower silicon content than usual and add ¼-1 per cent nickel.

Cams:

Maximum hardness and wearing properties are desired consistent with machinability. For small cams use low silicon iron with 1 per cent to 3 per cent nickel. On large cams, low silicon with 1 per cent to 5 per cent nickel or nickel and chromium in ration of 3 to 1.

Castings, Electrical:

In many cases an iron casting is required which is *non-magnetic;* i.e., for frame and end-ring castings for motors and generators. Use "Nomag" iron.

Castings (thin section), Manifolds, Throttle Bodies, Special Valves, Switches and Fuse Boxes, etc.:

A fine-grained, tough iron free from porosity is required. Use ¼-2 per cent of nickel and lower the silicon content to eliminate difficulty with porosity.

Cylinders, Engine, Pump, etc., and Cylinder Liners (heavier section):

Good wearing properties combined with a close dense iron are required for this work. Use a low silicon, low phosphorus iron and nickel. The silicon content depends on the thickness but for castings ¾" to 1¼" thick, use 1 per cent silicon with 1.25 per cent to 2.00 per cent nickel. For heavier sections, use lower silicon and add 0.2 per cent to 0.4 per cent chromium with the nickel.

Coupling Castings:

Freedom from porosity and internal shrinkage, with good strength and machinability, are essential. Use a low silicon, low phosphorus iron with 1 per cent to 2 per cent nickel.

Dies for Forming and Power Hammers:

Strength, toughness and wearing properties are essential. Use 0.75 per cent to 1.25 per cent nickel with 0.30 per cent to 0.40 per cent chromium in order to develop maximum strength.

Gears and Pinions:

Strength, good wearing properties, absence of porosity and internal shrinkage are desired. Use a low silicon iron with 1 per cent to 3 per cent nickel for small gears; for large gears, nickel and chromium in 3 to 1 ratio to secure desired hardness.

Hardware; Lock Cases, etc.:

This is usually cast in high silicon iron. For parts requiring increased strength, add 0.75 per cent to 1.00 per cent nickel with 0.30 per cent to 0.40 per cent chromium.

Molds:

Fine grain iron with hard but machinable surface is required. Use a low silicon iron with 1 per cent to 2 per cent nickel, or if necessary to use higher silicon, add nickel and chromium in 3 to 1 ratio.

Pipe Balls:

Use low silicon iron with 0.75 per cent to 1.50 per cent nickel and 0.50 per cent to 0.75 per cent chromium to resist scaling at high temperatures.

Pistons:

Add 0.75 per cent to 1.25 per cent nickel to improve machinability and resistance to wear.

Piston and Packing Rings:

Springiness, wear and machinability are required. Add 0.25 per cent 0.75 per cent nickel to rings of small section to prevent chill and refine grain. With large rings cast in pots, use a low silicon iron with nickel to increase the elastic limit. If necessary to use high silicon add nickel and chromium in ratio 3 to 1.

Pump Bodies, Runners, Plates:

A fine grain, wear-resistant iron free from porosity and internal shrinkage is required. Use a low silicon iron (silicon content dependent on section), together with ¼ per cent to 3 per cent of nickel, depending on hardness desired. For very heavy sections use nickel and chromium in 3 to 1 ratio.

Resistance Grids:

Add 3 per cent to 5 per cent to improve toughness.

Rolls:

Use low silicon iron with 0.75 per cent to 1.50 per cent nickel with 0.50 per cent to 0.75 per cent chromium to develop increased strength.

Wheels—Gray Iron:

Toughness and strength combined with machinability are essential. Use a low silicon iron with some steel addition and with 1 per cent to 2 per cent nickel or nickel and chromium.

Boiler Water Treatment

Engineering, 28 May, 1926.—Given sound design and construction and ideal feed water, the life of a steam boiler would be only determined by causes outside itself, such as the need for a higher pressure, or demands for more steam, arising from changes in processes of manufacture, or increase of business. As things are, however, overheating, due to scale, and corrosion, put many a boiler out of action long before its proper time.

A steam plant, i.e., boiler and engine, is fundamentally a distilling apparatus, from which the distillage is always purer than the residue. Borrowing the phraseology of another profession, a boiler may be said to be always suffering from autointoxication. Every moment of its working existence is devoted to sending out relatively pure water in the form of steam, while retaining the impurities, to its own disadvantage. If we may pursue medical analogy a little further, the temperature of the plant is abnormal, and the wide difference between the ordinary temperature of water, and that usual when it is being converted into steam is responsible for quite different internal reactions under the two sets of conditions.

As is well known, opinion among engineers and steam users is divided on the question of handling boiler feed water. One party prefers water softening plant, in which treatment is given to a dilute fluid outside the boiler.

The other relies on the use of so-called "boiler compounds," which are designed to operate on the concentrated liquid inside the boiler. On the whole opinion leans to the first-named method. Hardly any modern book on boilers or boiler management can be studied without finding in it caustic or disparaging remarks about the use of "boiler compounds," or about those who supply them. It would appear, however, that the practice of the latter has not been quite so wide of the mark as such criticism would suggest, though it may sometimes be based upon empirical rules rather than on scientific reasoning.

It is, after all, the water inside the boiler that really matters. This does not necessarily imply the condemnation of water treatment outside the boiler, which would be absurd. But it emphasizes the necessity of maintaining inside the boiler, at high temperature and pressure, the corrected conditions produced at atmospheric pressure and seasonal temperature by, say, a softening plant.

This is no newly recognized point. Indeed, most reflective students will have realized the practical side of the question when, in testing for calcium in feed water, they are instructed first of all to evaporate their sample to one-tenth its original volume. It is also some years now since Messrs. G. and J. Weir introduced their corrosion detector, in which the process of corrosion can be observed on a polished disc immersed in the water actually being evaporated in the boiler. This instrument it will be remembered is supplemented by an electrical salinometer, which is of assistance in making an accurate diagnosis.

In spite of such examples however, the importance of the cardinal differences between internal and external conditions has not always received the attention it deserves, and the recent work of Mr. R. E. Hall, physical chemist to the U. S. Bureau of Mines, is noteworthy as supporting this fact.

It is a commonplace that the deposition of several substances held in a solution does not proceed simultaneously; but the part played by the difference in solubility in the actual physical separation of substances is not so generally recognized in the boiler-using world as in some industrial spheres. In the production of common salt, for instance, the principle is intentionally applied. The separators consist of large rectangular concrete boxes, relatively shallow, with six or seven large steam pipes, immersed in the brine, running through them. The brine, in an example to which we may refer, contains also calcium and magnesium sulphates, and is not brought to boiling-point, but is kept as hot as possible without ebullition so that disturbing currents may be avoided. The liquid immediately round the pipes is thus at a high temperature, but that in contact with the bottom and sides of the box is considerably cooler. The result is a well-marked separation of the less soluble subtances in the brine. The steam pipes become covered with a hard scale consisting of nearly 85 per cent of calcium sulphate, while to the sides and bottom clings a soft deposit of almost pure sodium chloride—99 per cent to be precise.

A similar phenomenon is frequently observed in boilers, where the internal feed pipes may become nearly choked up with scale, while the remainder of the boiler is comparatively clean. It occurs in economizers, and its principle is utilized in some types of softening plant in which the feed water is heated.

The true significance of this effect is, however, rarely grasped in the average plant. We may illustrate the point by another example. Mr. Hall instances the case of a Bigelow-Hornsby boiler consisting essentially of three groups of long straight tubes, with independent drums, connected by circulation tubes. The first group of tubes in this type of boiler is inclined at an angle of about 60 degrees to the horizontal over the furnace, the second is vertical, thus leaving a large inverted triangular space between the two. The third group is also vertical and is separated from the second by a brick baffle. Obviously, all three groups are under different temperature conditions, and an analysis of the scale revealed in each a dis-

tinctly different type of separation of the impurities. The first group contianed a hard and growing formation of nearly 94 per cent calcium sulphate. In the second there was some porous scale consisting of about 88 per cent calcium carbonate, while the third was practically clear of scale, but showed a mud consisting of rather more than 40 per cent calcium carbonate, with considerable percentages of magnesium silicate and hydrate. The feed water contained sulphates and during the period of observation was being treated with lime and soda-ash externally; but it is obvious that this process had failed to function properly, though no doubt a sufficient quantity of the reagents was originally supplied. The explanation appears to be that the excess carbonates were decomposed at an early stage, probably in the lower temperature zone of the third group. The field was thus left clear for the deposition of the hard sulphate scale on the high-temperature areas of the first group—that is, just where it was least desirable. It may be recalled that Mr. Stromeyer, in 1907, reported an investigation of scale in a marine boiler which indicated a similar local separation.

Mr. Hall follows up these facts with a microscopic examination of calcium sulphate scale, which reveals the formation of long needle-like crystals normal to the surface, apparently indicating growth in a saturated solution, and not deposition of suspended material. In some cases, however, the crystallar interspaces entrap such matter, and so carbonates, for example, may be found embedded in the sulphate.

Against all this must be placed the extensive use of water-softening plants. For these the claim is commonly made that feed-water can be standardized within defined limits, so that, provided attention is paid to systematic blowing down and changes of water based on the rate of evaporation, adequate control is to be had over scale formation.

The point of the whole question really is, that in some cases external treatment alone can hardly be expected to be effective because conditions are changed after it has been carried out. Nor, as a matter of fact, is indiscriminate dosing with this or that specific likely to be any more successful. What is really wanted for successful treatment is a quantitative statement of the contents of the boiler from time to time, now only roughly tested by the salinometer. The matter turns upon the correct determination of the ratio between carbonates and sulphates, not in the dilute feed-water, but in the concentrated boiler water.

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The Hardening and Tempering of High Speed Steel

Engineering, 18 June, 1926.—High speed steels are well known to be very complex alloys, a fact readily grasped when it is considered that even simple types contain elements such as tungsten, chromium and vandium in addition to those usually found in plain steels, while the newer varieties also contain cobalt, molybdenum, etc. Owing to this complexity, only one type of steel has been dealt with, the two steels experimented upon being similar in every respect except for carbon percentage. One steel, denoted by the symbol J1, is that which, in Great Britain, is probably the most popular, and has already received a considerable amount of attention from scientific investigators. It has the following approximate composition:

	Per Cent
Carbon	0·55-0·65
Silicon	0·20
Tungsten	13·0-14·0
Chromium	3·0-4·0
Manganese	0·4-0·5
Vanadium	0·25-0·50
Sulphur	0·05
Phosphorus	0·06

The other steel on which some tests have been carried out, designated J_2, is exactly similar to J_1, except that the carbon contents is 0·7 per cent to 0·8 per cent.

Very different views on the exact technique of heat treatment are held. Some consider that the proper hardening temperature lies anywhere between 1,100 degrees C. and 1,200 degrees C., while others assert that the steel must be subjected to a temperature little short of fusion—*i.e.*, 1,300 degrees C. to 1,350 degrees C. This diversity of opinion can well be understood. The different duties which tools, such as reamers, twist drills, lathe tools and milling cutters, have to perform are so varied that it seems fairly obvious that one common treatment may not confer the most efficient properties on all these types of tools. In the hardening operation, the high temperatures employed cause the molecular mobility of the alloy to be greatly increased, so that the time of soaking is a considerably more potent factor in producing satisfactory results than in the case of straight carbon steels, where the times of soaking are very much longer, bulk for bulk. The phenomenon of secondary hardening and the drop in hardness after tempering in the neighborhood of 400 degrees C. to 500 degrees C., followd by a subsequent rise in hardness at 600 degrees C., is fascinating, and it affords, in the author's opinion, great possibilities in commercial practice. This phenomenon was clearly shown by Edwards, but his paper dealt in the general and preliminary way with the subject as applied to steels containing tungsten and chromium. No single type was dealt with in close detail, whereas the object of the present paper is to place on record certain observations on one particular type.

Part I

Preliminary Investigation on the Effect of Hardening and Tempering on the Microstructure, etc., of J_1 and J_2 Steels.—The material used in this series of tests was supplied in the form of ½-inch square bar, which had been annealed after rolling. The test pieces all consisted of small lengths 1½ inches long, so that the mass of each was practically the same. Each piece was nicked in two places, in order that it could be fractured after hardening. After hardening, each piece was broken into three pieces, to permit of the examination of the fracture and also to provide two further test pieces for tempering at 600 degrees C. and 680 degrees C., these two tempering temperatures being largly used in the manufacture of high-speed steel tools. Great attention was paid to the hardening of the test pieces as regards temperature and time in soaking. Heating was conducted in a small dry-gas-fired furnace, the temperature of which was measured by a Féry instrument, which was repeatedly calibrated against a standard platinum-platinum-rhodium couple. Various temperatures and times of soaking were used, and in all cases the pieces after heating were cooled in a medium air-blast. Tempering was carried out in a salt bath, the temperature of which was controlled by means of a platinum-platinum-rhodium couple.

A study of the photomicrographs showed that the first specimen to give a completely hardened structure was that hardened from 1,250 degrees C. after soaking for ten minutes. The only other ideal structure was given by a specimen hardened at 1,300 degrees C. for two minutes.

A temperature of 1,300 degrees C. seems to be slightly high for hardening, unless the time of soaking is very carefully watched. Thus, after one minute, the steel is not hardened completely, while in five minutes crystal growth has taken place. One sample, hardened at 1,300 degrees C. for ten minutes, showed enormous crystal growth. It is interesting to note that the structure develops on tempering into coarse martensite, and this becomes more marked in the specimens hardened from 1,350 degrees C. A sample, soaked at 1,350 degrees C. for one minute, was not completely hardened, while two minutes at this temperature produced large crystal growth. This

structure, after tempering, showed a very much more marked acicular structure. Soaking for five and ten minutes at 1,350 degrees C. produced a very coarse structure, and a peculiar herring-bone constituent at the crystal junctions made its appearance. In the tempered state these specimens showed very much coarser martensite, and the eutectic constituent persisted. The over-heated specimens showed a development of structure inside the crystals, and the interior of the crystals darkened rapidly on etching, in contradiction to the very slow attack which took place in sections possessing the small austenitic structure.

Certain specimens were etched in Yatsevitch's reagent, $NaOH + H_2O_2$). The herring-bone constituent was shown up in a marked fashion, and the etching plainly showed the increase in the amount of this constituent with higher temperatures. According to Yatsevitch, this reagent attacks the complex carbides. Certainly, if a correctly hardened specimen is polished and etched in this reagent, the only markings which appear are a few black specks, which correspond to the brilliant white specks produced when etching is carried out in alcoholic 4 per cent nitric acid. It will be found that such specimens which show a small-grained polygonal structure on etching in HNO_3 do not show up the crystal boundaries in Yatsevitch's reagent as the overheated specimens do. The Brinell hardness figures of the tempered specimens throw an interesting light on the behavior of the hardened and the unhardened specimens. In all cases where the specimens were completely hardened, the hardness drops only slightly, the lowest figure being 592, which is still a satisfactory cutting hardness, even after tempering at such high temperatures as 600 degrees C. or 680 degrees C.

The under-hardened specimens, as diagnosed by microscopic examination, lose their hardness rapidly on tempering. The over-hardened specimens, on the other hand, do not lose their hardness at all on tempering, under the conditions here described. As an example, the following three sets of figures may be compared:

	Brinell Hardness.		
	Over-hardened Steel D10.	Correctly hardened Steel C2.	Under-hardened Steel C1.
As hardened.....	661	661	622
Tempered at 600 deg. C....	661	661	534
" " 680 deg. C....	661	592	464

From an examination of the microstructures, the fractures and the Brinnell hardness, it would appear that a temperature of 1,250 degrees C. to 1,275 degrees C., for a suitable length of time, gives the best results on the particular sections experimented with. This temperature appears desirable on account of the slightly longer time necessary for complete soaking. With the higher hardening temperatures and the very much shorter time of soaking, the operation is decidedly dangerous, as a slight error in the time of soaking has a considerable effect in under- or over-hardening as the case may be.

A very important conclusion from this preliminary work is that the Brinell hardness and the appearance of the fracture in the hardened state are no criteria of correct hardening.

The Effect of Tempering J1 Steel at 600 degrees C.—Nine ½-inch cubes of similar steel were hardened as described in the previous section. Since the mass of these specimens was about one-third of those dealt with previously, the hardening treatment adopted, in accordance with the results

already obtained, was 1,260 degrees C. for two minutes. Micro-examination proved that this treatment was satisfactory, the specimen showing the correct small austenitic structure. Each of the specimens was found to possess a Brinell hardness of 661. They were then tempered in nitre at 600 degrees C. for two minutes and the hardness redetermined. They were tempered again at various temperatures, 100 degrees C., 200 degrees C., etc., up to 600 degrees C., 680 degrees C., and 750 degrees C. for ten minutes, and retested for hardness. The specimens were retempered at the same temperature as before, and hardnesses were again determined. The tempering was repeated for a further ten minutes, and the hardnesses were redetermined, so that in all the specimens received thirty minutes total tempering at their respective temperatures.

The results show that tempering at 600 degrees C., after hardening, reduces the hardnesses uniformly, but that, after this treatment, tempering at any temperature up to and including 600 degrees C. makes no appreciable difference to the hardness, as would occur to specimens which have not been tempered at 600 degrees C. It is well known that the hardness drops on tempering at 400 degrees to 500 degrees C., and rises again on tempering at 600 degrees C. only in specimens which have received the correct hardening treatment. Tempering at 680 degrees C. produces a distinct drop in hardness, while at 750 degrees C. this effect is considerable. The important point brought out by these tests is that this material, after correctly hardening and tempering at 600 degrees C. for two minutes, appears perfectly stable as regards hardness at any temperature up to 600 degrees C., since tempering for as long as thirty minutes did not diminish the hardness.

Investigation on J2 Steel.—The work on J2 steel followed the same lines as that on J1 steel described in the first section. The hardening technique was also similar, as the conditions were the same as those detailed above.

A study of the photomicrographs showed that the first specimen to give a hardened structure was that hardened at 1,150 degrees C. after soaking for five minutes. There were signs, in this specimen, of an austenitic crystal structure. The latitude in hardening is comparatively wide, 1,150 degrees C. for ten minutes, 1,200 degrees C. for five minutes and ten minutes all giving similar results. The temperature of hardening for this material should not reach 1,250 degrees C., since soaking for only one minute produces a large structure, and specimens hardened at higher temperatures and for longer times show progressive crystal growth, which structure on tempering develops into coarser martensite than is desirable. Similar observations as regards overheating are noted with the higher carbon steel as with J1, the difference being, however, that the overheated structure is developed in the J2 steel at a considerably lower temperature. The first indication of the intercrystalline eutectic constituent in J1 steel was found in the specimen hardened at 1,350 degrees C. for five minutes, while 1,250 degrees C. for ten minutes was sufficient to cause the commencement of its production in J2 steel. While it was not marked, it became very pronounced in a specimen hardened at 1,300 degrees C. for five minutes. As in the case of the J1 steel, the completely hardened specimens of J2 steel retained their hardness on tempering, while in those under-hardened the hardness was rapidly lost.

The main conclusions to be drawn in comparing the results of the two steels are: (1) The increase in carbon content of 0·1 to 0·15 per cent in a 14 per cent tungsten high-speed steel causes a diminution in the temperature required for correct hardening, the reduction being something like 100 degrees C. (2) The effect of temperature on the hardened structure is much more marked with the higher carbon steel, the production of an overheated structure being effected much more easily. (3) The same applies to the production of the intercrystalline eutectic constituent, which appears

to resemble closely the eutectic formed in high-speed steel cooled from fusion. The production of this constituent is apparently due to incipient fusion which takes place at the crystal boundaries. (4) The presence of this intercrystalline constituent appears to cause excessive brittleness in the hardened material. (5)The range of temperature and time for hardening the higher carbon steel is greater than for the lower carbon material. With the specimens experimented upon, between 1,150 degrees C. and just over 1,200 degrees C., and five to ten minutes, according to the temperature, appears suitable for J2 steel, whereas with the J1 steel, 1,250 degrees C., or just over, seems to give the best results. If this temperature is exceeded by any appreciable amount, the time necessary is reduced to such a short period as to reduce the factor of safety in commercial hardening. (6) The higher carbon material is considerably more brittle when hardened. (7) A peculiar miscrostructural effect is evident in the specimens which are not quite hardened—that is, those which, though showing a high hardness figure after hardening, lose their hardness rapidly on tempering. (8) The higher clusion already arrived at with the J1 series is confirmed in this higher carbon series—namely, that hardness and fracture in the hardened state are no criteria of the material having been correctly hardened to produce the red-hardness property.

Part II

Effect of Time and Temperature of Hardening and Tempering on the Hardness of J1 and J2 Steels.—The material used for these investigations was similar to that employed in Part I. The bars of ½ inch square section were received in the annealed condition, and the specimens used were cut off so as to form pieces ½ inch cube, weighing approximately eighteen grams. The specimens were hardened, four at a time, in a Brayshaw gas-fired furnace. On removal from the furnace they were cooled in a medium air-blast. Tempering, up to, and including 300 degrees C., was carried out in an oil-bath, and above that temperature in a Niter bath, the former being suitably controlled by a base metal thermocouple, and the latter by a platinum-platinum-rhodium couple. Micro-examination was carried out on samples from the various batches after hardening, to insure that each batch had received the same hardening treatment, and one specimen was kept in the hardened state for reference. Examination of the tempered specimens has not yet been made, but it is intended to do this at a future date. After hardening and tempering, the specimens were lightly ground (wet) so as just to remove the scaly surface, and then polished up to the 000 emery paper to facilitate accurate readings. Brinell hardness determinations were then made.

Scheme of Research.—Five series of specimens of J1 steel are being investigated; in the first four series, the hardening temperature has been kept constant, and only the time of soaking varied from one to eight minutes, while in the last series the hardening temperature has also been increased.

The hardening temperature, 1,260 degrees C., has been adopted in all cases, except the last, as this was the best temperature indicated in the preliminary investigations described in Part I. The treatments were designed so that the specimens of Series A were not completely hardened (1,260 degrees C., one minute soaking), those of Series B were just completely hardened (1,260 degrees C., two minutes soaking), and those of Series C, D, and E represented successive stages of over-hardening. Micro-examination of representative samples from each series showed that these conditions had been attained. Tempering was carried out at temperatures of 100, 200, 300, &c., up to 600 degrees C., and also at 680 and 750 degrees C, for periods varying from 1 to 10 minutes. At the present time, Brinell hardness results have been obtained on the specimens of Series B only.

Definite signs of secondary hardening in the neighborhood of 600 degrees C., were obtained, although the hardness produced by tempering never reached or exceeded the original hardness in the hardened state. It was evident, however, that the series had been satisfactorily hardened, and this was confirmed by micro-examination of the untempered specimen; a small austentic structure, considered to be representative of correct hardening, was to be seen. In the first place, the hardness of the specimens, without tempering was 670. With increasing tempering temperature, the hardness gradually dropped to a minimum, at a temperature range 400 degrees C. to 500 degrees C. A rise led up to the secondary hardening zone, in the neighborhood of 600 degrees C. Above 600 degrees C. the hardness fell away rapidly with increasing temperature.

Investigation showed that the hardness reached a minimum between 400 degrees C. and 500 degrees C. in the neighborhood of five minutes. It was noted that tempering at 500 degrees C. did not produce such a marked softening; after one minute's tempering, the hardness dropped sharply, but further tempering caused a rise, which reached a maximum at four minutes, producing the greatest hardness after tempering of all the treatments. Further tempering, up to ten minutes, produced a slow decrease, but there were indications that the material was nearly stable.

The present theory of the secondary hardening phenomena of high-speed steel attributes this hardening during tempering to the production of martensite, which is somewhat harder than the austenite produced during the hardening. In the steels under review (heated to 1,260 degrees C. for two minutes and cooled in an airblast) the maximum secondary hardening effect occurs at 600 degrees C., but there are signs of secondary hardening at 500 degrees C. if the tempering time is long enough. The results show that, in the material tempered at 600 degrees C., the maximum breakdown of austenite to martensite, causing maximum secondary hardening, occurs after tempering for four minutes. Longer tempering times produce a slight breakdown of this martensite.

Experiments with Steel J2.—Similar work to that described in the previous section was carried out on the higher carbon steel J2. The temperature of hardening for this series, designated "Series N," was 1,220 degrees C. and the time two minutes, these being decided upon after consideration of the results obtained in Part 1. Tempering was carried out as before, and the Brinell hardness numbers of the specimens determined. An examination of the results obtained for Series N showed that, in certain respects, they were similar to those already described for Series B. First, it was noticed that the initial hardness (636 Brinell) of the material was lower than that of the B Series. Secondly, the hardness dropped gradually with increase of tempering temperature until a minimum zone was reached in the neighborhood of 500 degrees C. Thirdly, the hardness then rose again to figures which were considerably higher than the original hardness in the hardened state. In the lower ranges of tempering time, the maximum secondary hardening took place at 680 degrees C. up to five to six minutes, while at ten minutes the maximum effect took place at 600 degrees C. Investigation showed that the hardness dropped rapidly when the steel was tempered at 600 degrees C. up to three minutes, and then rapidly hardened up again, until, at ten minutes, the material was harder than it was originally, but even at this point it was not stable. There were signs of secondary hardening at 500 degrees C. and 400 degrees C. if the tempering time were long enough. Further series are being investigated, but at the moment all that can be said is that the initial hardening treatment has a profound effect on the behavior of high-speed steel during tempering.

The Bracketless System of Ship Construction

Engineering, 21 May, 1926.—In the year 1907 Sir Joseph W. Isherwood introduced the system of ship construction which bears his name. The principles underlying this method of building are the elimination of the multiplicity of closely-spaced transverse frames and beams of the usual system of building, and the use in place of them of a much smaller number of strong transverse frames associated with longitudinals. On these the plating and deck is fitted directly, a matter of importance, as it enables the shell and deck plating to be considered a part of the transverse girder when calculating the stresses. Transverse strength is obtained by this means. For the provision of longitudinal strength continuous longitudinal girders are used which pass through slots in the transverse frames. One feature of the construction is that the pillaring of the ship may be rearranged to overcome a cause of serious obstruction in the holds, pillars being only required at the strong transverse beams. As a result of the introduction of this system of shipbuilding the structure of a ship may be simplified, all its parts made easily accessible, and, also, a substantial saving in weight of steel may be effected. Successful results having been obtained with the early vessels, the advantages of the method of construction were soon recognized, and there are now in service or being built a total of 1,502 ships of this type, which have an aggregate carrying capacity of 12¾ million tons. Of this number 705, of an aggregate capacity of 6¾ tons deadweight, are oil tankers, and comprise the bulk of the world's tonnage for this class of vessel. Lloyd's Register of Shipping having adopted the system in the formulation of its rules for oil-carrying vessels, it has now become the standard of strength for vessels carrying oil in bulk.

A further departure from the usual practice in ship construction has now been made by Sir Joseph W. Isherwood and Mr. William Isherwood, to which they have given the name "Bracketless" system. It was the subject of an interesting paper read by them at a recent meeting of the Institution of Engineers and Shipbuilders in Scotland. In the development of the original Isherwood system of construction of oil tankers, it was considered essential to connect all the longitudinals to the transverse bulkheads, not only those on the sides, bottom and deck of the vessel, but also on the middle-line bulkhead, and at the same time to connect the horizontal stiffeners on the transverse bulkheads to the longitudinals on the shell of the ship and those on the middle-line bulkhead. In each case these connections were made with brackets. This, while it greatly reduced the trouble experienced due to heavy weather at the bulkhead connections in transversely-framed vessels, was only attained at considerable cost and some inconvenience in the actual building operations. Again, should damage be sustained in the neighborhood of the bulkhead breackets in a tanker, through grounding or other causes, the cost of repairs would be great. It was to overcome these difficulties that the new method of construction, which is applicable to all types of vessels, whether longitudinally framed or transversely framed, was introduced. It was found on investigation that continuity of strength could be maintained with the brackets eliminated, the first consideration in the design of a bracketless tanker being the spacing and strength of the transverses. Should the brackets be removed, it was obvious that the transverses have more work to do, as the part performed by the bulkheads in fixing the ends of the longitudinals was transferred to the deep transverse, and these required to be of greater strength than in a bracketed ship. An investigation was made by the designers of this new system of construction, using Clapeyron's Theorem of Three Moments, to determine the most suitable spacing. In this the longitudinals were considered as continuous beams between the transverse bulkheads, the transverses in the tank, usually two or more, and the two bulkheads, being considered as supports to the longitudinals. Diagrams of free bending

moments, fixed bending moments, shearing forces and deflections were made to determine the proportion of the load to be taken by the spans between the transverses. The ratios used for the purpose, assuming two transverses between each pair of bulkheads, were 10-10-10, 9-10-9, 8-10-8 and 7-10-7. The results obtained in this work are shown in the accompanying table.

Arrangement of transverses	10–10–10	9–10–9	8–10–8	7–10–7
Maximum bending moment, ft.-tons	26 · 48	27 · 60	28 · 60	31 · 3
Maximum bending moment ratio	1 · 000	1 · 043	1 · 080	1 · 183
Shearing force at end of bottom longitudinals, tons	10 · 97	10 · 12	9 · 60	8 · 34
Shearing force ratio	1 . 000	0 . 922	0 · 875	0 · 760
Maximum deflection on spare adjacent to bulkhead in inches	0 · 027	0 · 021	0 · 015	0 · 008
Deflection ratio	1 . 000	0 . 778	0 . 555	0 . 297

On examination of the figures in this table it was decided that the best results would be obtained with a proportion of 7-10-7 for the spacing, without entailing any material increase in the weight of a vessel. The increased maximum bending moment, over that obtained with equal spacing, might be taken care of by increasing the scantling of the longitudinal to maintain the same internal stress as in the other arrangement. The advantage of using a 7-10-7 proportion from the standpoints of shearing force and deflection were obvious from the results given in the table.

Having relieved the ends of the longitudinals of a stress which is now transferred from the bulkheads to the deep transverses, the question arose of maintaining sufficient continuity of the longitudinal material in way of the transverse bulkheads. This was obtained by fitting doubling plates to the shell end deck plating in the vicinity of the bulkheads. In the ordinary Isherwood system, the longitudinals were all cut in way of the transverse bulkheads and were attached to them by plate knees or brackets. The value of this bracket arrangement, considered as a member contributing to the longitudinal strength of the vessel, cannot be determined exactly. It was generally agreed, however, that they were not equal to the tensile strength of the longitudinal, principally due to the eccentric pull that undoubtedly took place in way of the brackets. They, however, served their purpose, to a great extent, and helped in the production of a ship immeasurably stronger than the ordinary transversely-framed ship. While elimination of the brackets connecting the longitudinals to the transverse bulkheads was the main reason for the introduction of the new method of construction for tankers, it was apparent that the elimination of all brackets, as far as possible, would be desirable, provided the strength of the vessel could be maintained without any undue addition to the weight of the structure. It was found that this could be done, with the exception of the connection of the bottom transverses, the upper deck transverses and second-deck transverses to the caulking side of the center bulkhead and upper-deck transverses in summer tanks to the trunk side. In the ordinary Isherwood system it was usual to make the width of the center bulkhead web equal to that of the side transverses, but in the new system of construction it was found that some reduction in width of the center bulkhead web was justified, in view of the transverse brackets fitted on the opposite side.

In the two first vessels of the bracketless type, which are now under construction, there is a reduction in the number of pieces to be handled in their building of about 36 per cent, which in the case of a 10,800-ton vessel means a saving of 5,500 pieces, being brackets and their connecting angles. The construction also affords considerable savings of about 23 per cent, to be made in caulking, and about 7½ per cent in riveting. It will, there-

fore, be appreciated that large savings may be made, by the use of the bracketless system of construction, in the cost of assembling a vessel, while the difficulties of repair, when a ship is damaged in the neighborhood of the bulkheads, will be much reduced if the brackets in that region are eliminated.

Oil Engines Will Have Plenty of Fuel

The Marine Journal, 29 May, 1926.—When dealing with America's petroleum problem a few years ago, I laid stress upon the need of developing methods which would insure our getting more values out of such oil as we now have. This meant recourse not only to better methods of production and refining but included, as well, a more economical utilization of the petroleum available. It is probably not an exaggeration to say that we have heretofore been extremely wasteful in the way in which we have employed fuel oil for the raising of steam for power purposes, and it is in this direction that we must henceforth economize wherever it is practicable to do so.

With this thought in mind, it will be easier for me to express an opinion as to the future supplies of fuel oil for internal-combustion engines of the so-called Diesel type—a wider employment of which has unquestionably been hindered by fears of a failure of our petroleum resources. This misapprehension has, in part, been the consequence of a misunderstanding or misinterpretation of the repeated warnings broadcasted by government geologists and others to the effect that, at the present rates of consumption and under the prevailing practices in the oil-producing industry, the supplies of crude oil existing in our oil fields would last us but a few years longer.

Great Undeveloped Sources

Perhaps the situation may be summarized as follows: Supplies of cheap, "flush" oil from new pools cannot be counted on to meet all demands for many years to come; other undeveloped sources of supply are incomparably greater than the resources from which oil has been obtained up to this time, and these latent resources should meet all our essential needs indefinitely—among these needs being fuel oil for oil engines; and, when it becomes necessary to rely on these latent resources, higher, yet not excessively high prices may be expected for petroleum products. Higher prices at such times will, no doubt, cause many users of cheap fuel oil to revert to the use of coal or to other alternative sources of heat and power. Even so, the oil engine will have such a margin of advantage over the other users of fuel oil that it will be able to compete successfully for supplies under well-nigh every conceivable contingency.

Newspaper Headlines Misleading

To those that formed their opinions of this vital matter of our petroleum resources by reading only newspaper headlines, it is understandable why they should believe that the day of a fuel-oil shortage is not remote. In their endeavors to reduce the statements of government geologists and other authorities to the limitations of headlines, the newspapers have omitted all explanations or qualifications, and therefore these captions have proved misleading to those of the public that read as they run. It has been the purpose of the experts merely to forewarn the country—not to alarm, in order that provision should be made that would enable us to pass without disruptive abruptness from the conditions to which we are accustomed to a new era of power generation wherein oil products would not be drawn from only one primary source but from many of them. That these well-intended efforts have been misinterpreted is not surprising when we consider the complexity of the problem and the difficulties incident to presenting conditions in the oil industry in an adequate way to the uninformed

general public. When the whole story is told and its lesson grasped, then the future does not appear in an alarming light.

A full discussion of the many angles to the question of fuel-oil supplies for oil engines is not warranted here, and the reasons for the opinions held by the writer are presented only in brief. To the oil engine owner, the subject resolves itself into two questions: What will be the future supply of oil? What will be the competitive position of the oil engine for such supplies as may then be available?

Present Production Methods

For some years in the recent past there was an oversupply of crude oil, caused by the discovery of new fields and the working of them faster than markets could be extended to absorb the increased production. Such periods of overproduction have alternated with periods of undersupply, and no one can foretell how these changing circumstances may succeed one another or how long each will endure. It is obvious, however, that eventually the time must come when new pools can no longer be found fast enough to offset the decline of old wells—in short, the pools will not be able to provide for continually increasing consumption.

It must be understood that an oil well starts with a relatively large production and thereafter rapidly declines; and it is equally important to remember that a pool is but a number of wells. Were no new wells drilled, oil production in this country would drop anywhere from 25 to 40 per cent in a year's time. Generally speaking, 50 per cent of the production today is drawn from about 4 per cent of the wells that average less than a year in age, whereas 81 per cent of the oldest wells yield less than 10 per cent of the production—the old wells involving a daily expense many times greater than that required in connection with the larger prolific wells. Under such conditions, our oil needs can be met only through the continued discovery of new pools that will replace or make up the depletion of the old pools; but, at the rate that these pools are being searched out, it is obvious that the time is not far distant when the production of the country as a whole must pass the peak, just as has occurred in the case of some of the older oil-producing states—but on a lesser scale.

Other Resources

Were there no other resources, the situation might be alarming; but we are coming more and more to evaluate not only the limitations in discovery of such new flush pools—with attendant cheap oil—but also the unlimited latent resources which, because of this low-priced oil, we have not had occasion to develop. These latent resources are numerous, and our future oil needs will be met from the sum of them rather than from any one of them. Production from new flush pools will not disappear overnight; but a time will come, possibly within the near future, when such production will reach a peak and thereafter gradually decline. The problem will then become one of filling in the gap between this declining production and the ascending demand for oil. This will be accomplished partly by supplementing our supplies from other sources and partly by restricting consumption by shutting off the less efficient and the less essential users of fuel oil. But that we shall be able to pass through such a period of adjustment without some inconvenience is not reasonably to be expected.

What are these other resources? First of all, because in that way it will be possible quickest to meet any deficiency, it will be necessary to increase importations of oil from foreign countries—principally from South America. During the past decade, explorations have gone on continuously in Venezuela and Columbia, and fields have been discovered that should provide large supplies of petroleum when fully opened up. As these and other fields have been but barely scratched to date, and with much of the earth's surface not explored at all for oil, large imports can be confidently

expected for many years to come; but, because of the greater cost of developments in foreign countries, this oil from alien sources will probably not be so cheap as oil is at present.

Extraction Will Be Increased

Let it be emphasized at this point that we are by no means dependent or likely to be dependent upon foreign sources of supply to make up a shortage in fuel oil. We know, as a matter of fact, that but a fraction of the oil underground in any of the domestic fields is being extracted from our oil sands by the methods commonly employed—ways will be made available by which a considerable percentage of this residual oil will be recoverable. By two different processes, already devised, oil extraction has been increased in some wells from two to four times and under profitable commercial conditions, and a third process has been worked out which has proved of practical success in Europe. It has been demonstrated conclusively that the oil remaining in the sand—after mining by the usual methods—varies from three to nine times more than the oil already extracted from the pools in question. What average increase in extraction may be looked for cannot now be fixed with any certainty—in fact, the output will be determined largely by the price asked for the oil and what outlays will be warranted in recovering it; but it is clear that a tremendous increase in the yield will come from existing oil fields. Even so, this amplified supply will not come about all at once in sensational increases in production: the stimulated yield will be spread over many years in the form of a stable, moderately priced production.

Oil Shales

Considered upon a potential quantitative basis, the most important latent resource of fuel oil is our oil shales. These exist in enormous measures in both the eastern and the western parts of the country. Oil shale resembles a poor grade of cannel coal; and to obtain the contained oil it is necessary to mine, to crush, and to retort the shale. The quantities of oil in such shale deposits are vastly greater than the amounts of petroleum in our oil sands. Even so, the exploitation of our oil shales will require an immense sum of money and involve much time to develop satisfactory extraction methods and to install equipment of sufficient capacity to supply enough oil to meet any large share of our needs. Oil from oil shales will be available shortly, but in relatively small quantities; and the output will gradually supplement our other sources of supply as the technique is developed which will render practicable the commercial extraction of this oil on a suitable scale. Oil from these shales will be relatively but not excessively high-priced oil.

Processing

Other promising sources of liquid fuel are oils produced by the low-temperature distillation of coal as well as alcohols from various waste vegetable products and other sources. Some allowances must also be made for processes and sources not as yet demonstrated as commercially feasible—such as the chemical treatments of coal, etc., or the development of other power sources which seem remote today and yet may prove important factors in the life of an oil engine purchased at the present time. Any product that will replace gasoline will have its effect upon existing fuel oil because much of the gasoline now available is obtained by processing fuel oil.

The outstanding fact, so far as it concerns the expected useful life of an oil engine bought today, is that the future supply of liquid fuel can be drawn from large and varied sources, and the utilization of these is now merely awaiting demand. In short, a serious depletion of our oil supply

is inconceivable in view of the known facts and the avenue of relief which have been opened up in part and which are susceptible of nearly unlimited development.

Such being the case, let us consider the competitive position of the oil engine in the field of power production. This subject, in itself, is fully as important as the question of the total oil supply of the country. The real concern of the oil engine owner is his relative position—that is, whether or not he can lower his power costs and how his power costs compare with those of his competitor in making the same commodities or in selling the same sort of service. So long as his source of power is the lowest priced and most desirable for his particular operating or manufacturing conditions, then a general rise in the cost of power—affecting equally all alternative sources of power and all competitors in his field of trade—should be a matter of minor concern to him because, under such circumstances, the increased cost of power is passed right on to the consumer and the primary user of the power remains in virtually the same relative position.

Competitive Position of Oil Engine

The competitive position of the oil engine in the market for fuel oil supplies is an excellent one. Fuel oils constitute about half the total of the crude oil produced and consumed. The principal uses are in steam raising, in heat making, in gas making, in household heating, in metallurgical processes, for cracking into gasoline, and for driving oil engines. The percentages by use of these various users of fuel oils are not known to the writer except that oil engines utilize but a comparatively small part of the total of the fuel oils marketed. This is still true even after due allowances are made for those kinds of fuel oils that are not so desirable for use in the Diesel type of engine.

The largest part of these competitive demands for fuel oil can be satisfactorily taken care of with coal; and during recent years the surplus supplies of fuel oil have been successfully marketed only by inducing coal users to turn to oil by underbidding rival coal. Fuel oil is, therefore, in direct competition with coal, and the price of each of these fuels logically affects the price of the other. The Diesel engine is, accordingly, in competition with coal wherever the power needs can be supplied by steam generated in coal-burning boilers. A surplus supply of fuel oil, therefore, seeking to extend its markets must undersell coal and thus tend to keep down the price of coal. On the other hand, a decreased supply of fuel oil will contract the market for fuel oil and increase the demand for coal—inducing an increase in price of both oil and coal. With a decreasing supply of fuel oil there would come a progressive restriction in the use of oil and, concurrently, a reversion to coal, to water power, or to any other sources of heat and power that might be available. This reversion would occur first in those parts of the country and in those uses in which fuel oil offers the least margin of advantage over alternative sources of heat and power; and then concentration in the employment of fuel oil would be most marked in those localities and in those uses where fuel oil is most essential. Such being the situation and the prospect, it should be plain that the oil engine, with its superior economies, will be one of the very last of the users of fuel oil to be forced out of service.

MISCELLANEOUS

The Lessons of Jutland

Engineering, 28 May, 1926.—* * * * In this tremendous conflict every weapon employed in sea warfare played its part, for if the airships and the submarines which had been mobilized to cover the sortie of

the German battle fleet were not present during the actual fighting, they were so disposed as to be ready for action had the battle been resumed on the following morning. Even the airplane was represented by the machine that flew off from the deck of H.M.S. *Engadine* and brought back to Admiral Beatty a useful report of the enemy's movements. Ten years is a comparatively short period in the history of a nation, but in the development of naval science it may suffice to produce revolutionary changes. How little resemblance, for example, did the British Navy of 1873, with its mastless turret ships and numerous ironclads armed with rifled guns, bear to the Navy of 1863, which had consisted mainly of unarmored wooden ships equipped with smooth-bore ordnance. Again, what a striking contrast the fleet of 1904 afforded to that which proceeded to its war base at Scapa ten years later. Within that decade the navy underwent a complete transformation. The mixed-caliber battleship had given place to the dreadnought, the battle cruiser and the high-speed light cruiser had been evolved, the destroyer had grown into a sea-going ship, and the submarine become a potent and reliable instrument of combat. But if we compare the fleet that fought at Jutland with our present naval establishment we shall find no outstanding differences in respect of material. Capital ships of the type we possessed in 1916 constitute the backbone of our present fleet. Indeed, excepting only the two *Nelsons* and the *Hood,* our battle fleet is composed entirely of pre-Jutland ships, just as the whole of our cruisers and destroyers now in commission were built under war-time programs from designs directly inspired by the lessons of Jutland.

The growth of the capital ship has been arrested by international treaty, while smaller vessels are also affected, required as they are to conform to rigid limits of displacement and armament. But for this artificial impediment to progress all types of fighting craft, from the capital ship downward, might by now have developed out of recognition. It is important that the absence of any notable advance in naval material during recent years should be borne in mind, since weapons necessarily govern tactics. Consequently, were a fleet action to take place tomorrow under geographical and other conditions resembling those at Jutland, it must and would be fought out on very much the same general principles. Aircraft would, no doubt, be greatly in evidence, though there is no certainty that their operations would produce decisive results. It is extremely doubtful whether popular forecasts of aircraft compassing the destruction of battleships by bomb attack would be fulfilled, for the only airplanes able to participate in an action fought on the high seas would be those operating from carriers, and such machines cannot transport bombs of sufficient caliber to inflict serious injury on a dreadnought. The torpedo-plane, also, is an experimental, arm of which the efficacy under war conditions has yet to be tested. It suffers from the grave disadvantage of having to fly almost at sea level when delivering its attack, thus becoming a fair target for flat-trajectory fire. It is, we think, more as a medium for reconnaissance and communication than as an independent weapon of offense—save perchance against submarines—that the airplane will justify itself in naval warfare. Again, there is not the slightest reason to assume that submarines would materially influence the course and outcome of a deep-sea fleet action in existing circumstances. Neither in speed, maneuvering qualities, nor armament does the submarine show any appreciable improvement. On the other hand, the battleship, thanks to its bulge protection and improved subdivision, has become less sensitive to the blows of the torpedo. We therefore assert with some confidence that if Jutland were refought tomorrow the gun would again prove the decisive weapon, and that the capital ship, as a mobile carriage for the heaviest and hardest-hitting guns, would vindicate its reputation as the basic element of naval power. That the Admiralty war staff shares this view is made clear by the present organization of the fleet, which differs in no essential particular from that of 1916.

The literature of Jutland has now grown to imposing dimensions. Every phase of the battle has been recorded and debated by historians on either side, and even among the minor incidents there are few which remain obscure. The only important points on which enlightenment has not yet been vouchsafed are, first, the disconcerting vulnerability of our battle cruisers; and, secondly, the unsatisfactory effects of our gunfire. As to the first point, we have searched in vain through the official narratives of the battle for a clue to the mystery. Official circles appear to have adopted the theory that the *Queen Mary*, the *Indefatigable*, and the *Invincible* were all destroyed by "lucky hits," and small encouragement is given to those who seek a more scientific explanation of the phenomenon. But there is no gainsaying the fact that the ships were lost in consequence of some fundamental error in their design. Precisely where the weakness lay, whether in the inadequate strength or faulty distribution of their armor, in the plan of their barbettes and magazines, or in the method of ammunition stowage, can only be determined by those who have access to the complete designs. These ships were notoriously built to satisfy the exacting demands of certain officers whose tactical theories were largely disproved in practice. Long-range action was the keynote of our earlier battle cruiser designs, which provided a sufficient margin of speed for choosing the fighting distance, guns superior in range and weight to those of the probable adversary, and just enough armor to resist projectiles fired at extreme range. It does not appear that the climatic conditions normally prevailing in the latitudes where these ships were destined to fight were given a moment's thought. A further consideration overlooked was the natural and laudable desire of our fleet commanders to come to grips with the enemy whenever he showed himself at sea. At such a time the fine points of a new tactical doctrine are apt to go by the board. Thus, when Admiral Beatty sighted the German scouting squadron at Jutland he proceeded to close at full speed, and did not open fire until within 16,000 yards. Very soon the range had dropped to 13,000 yards, at which distance the smaller German guns were extremely effective against our thinly-plated ships, while their own heavily-armored vessels were able to resist our projectiles, deficient as most of them were in penetrative power. Had Admiral Beatty fought by the book he would have come into action at 18,000 yards or more, using his superior speed to maintain the range at this figure, and declining to be drawn within reach of the enemy's lighter guns. Had he pursued that course, however, the duel must have resolved itself into an indecisive game of long bowls, and it is highly improbable that the main fleets would ever have come into contact. To inflict fatal damage on the German battle cruisers at a range of ten miles would have demanded a higher standard of gunnery than was attainable with the methods in vogue at the date of Jutland.

It is, therefore, hardly to be doubted that the tactical doctrines governing the design of our battle cruisers were unsound. Jutland exposed the fallacy of building ships to meet purely hypothetical conditions. That is the first lesson of the battle so far as ship design is concerned. There are features of the *Nelson* class, such as the concentration of the main armament in the forepart of the ship and the resulting sacrifice of stern fire, which raise a suspicion that this lesson has not been taken closely to heart. We fear, too, that the design of the 10,000-ton cruisers now building in this country and abroad does violence to the same teaching. In effect these vessels are miniature battle cruisers, in which all the worst defects of the prototype reappear in exaggerated form. In order to achieve the highest possible speed, combined with a disproportionately powerful armament, their protection has been cut down to vanishing point. They must either engage at very long range or else incur the risks of summary destruction. It is true that special circumstances appear to have produced this dubious type of vessel, and that all the units of the class, foreign no less than British,

share in common its patent defects. Nevertheless, we question the wisdom of building fighting ships which may prove too vulnerable to fight, and a lively controversy is to be anticipated when, if ever, the plans of our new *County* cruisers are released for publication.

As for the disappointing results of British gunnery at Jutland, these must be ascribed to two main causes, poor visibility and an inadequate quota of armor-piercing shell. The great majority of our projectiles discharged in the action were of the high-explosive variety, which failed to make much impression on the stiffly-armored German ships. The value of H.E. attack on such targets had clearly been overrated by our gunnery experts. But whenever our A.P. shell went home they appear to have acted admirably. Readers may recall the series of striking photographs, published in *The Engineer* of February 20, 1920, which revealed the devastating effect of these shells on the German ships at Jutland. Visual evidence was afforded of the ease with which they had passed clean through turret and side armor up to a thickness of 12 inches, to explode inside with pulverizing force. The *Seydlitz* had no less than four of her five turrets knocked out, while the *Derfflinger* and the *Lützow* lost two apiece. Had our ships' magazines contained a larger proportion of A.P. projectiles it is virtually certain that many more German vessels would have been sent to the bottom. The experience of Jutland taught us that well-armored ships have little to fear from high-explosive shell, and should therefore be attacked with armor-piercing projectiles carrying the heaviest possible burster. There is good reason to believe that this lesson, at least, has been thoroughly digested by our naval authorities.

Nation Honors John Ericsson, Man of Vision

Power, June 1, 1926.—With the birth of John Ericsson at Langbanshytten, in a remote section of Sweden, on the last day of July, 1803, a new vision of steam as a power and its importance to navigation may be said to have come into the world. With untiring energy and application the boy spent his formative years in a gruelling study of mechanics and mathematics. His father a miner and teachers lacking within the vicinity of his home, he had his early education from the lips of his mother, a woman of remarkable qualities and perception. But the child himself was father to the inventor. He set himself questions and sought their answers, and of difficult problems he labored over the solution unaided. We have good reason to suppose that from this period on Ericsson labored more with the view toward fundamental discernment in what later developed as his chosen field, than he gave time or thought toward immediate exploitation. When his inventions were realized, they were, primarily, the achievements of his vision.

Early Training

The fortunes of the Ericsson family were greatly diminished by the Russo-Swedish War over Finland, and in 1811 the father sought employment on the Gota Canal, the largest engineering venture then being undertaken in Sweden. Finding himself, at the time hardly in his 'teens, surrounded by the stimulating atmosphere of the work, the boy rapidly skilled himself in draftsmanship, a science in which he remained an expert until his death. In a moment, it seemed, he was chief leveler for the development. By another year he had been placed as a cadet in the mechanical corps of the navy. But he soon joined the field chasseurs of Jemtland, and gave his time to a study of artillery.

While thus obtaining a broad and thorough training, the youth was hard at work fashioning the first model of his flame engine. News of it reached the court, and soon he was on his way to England on the suggestion and aid of the king, who strongly advised English cash and English opportunity for the furtherance of his talents.

With Braithwaite

True to the course of genius, Ericsson met with trying disappointments on his arrival. Owing to the difference in the fuel he was now obliged to use, the development and recognition of his flame engine was beset with difficulties. Soon, however, he became known to John Braithwaite, "builder of machines." A partnership ensued shortly. From that day each month was fraught with plans diligently executed. With heads and hearts as one, the partners added invention after invention to their credit. Foremost in importance among these was a water pump driven by compressed air.

Tubular Boiler

And now, the result of painstaking observation and experiment with thought of the need for greater power development, Ericsson saw the possibilities that lay in the further and more efficient harnessing of steam. "Steam" and "navigation" he had already linked together. The boiler fires of those days were temperamental. They burned or went out at will. Applying the principle of artificial drafts and a cleverly constructed tubular boiler, he found a solution. Surface condensation followed. Both of these inventions featured in the construction of the *Victory,* the first ship run by machinery below the water line.

All who are familiar with the history of railway development can recall the story of the race between Ericsson's steam engine, the "Novelty," and Stephenson's "Rocket." A Liverpool and Manchester company, owning a line running between the two cities, called for a performance of an engine drawing twenty tons, itself weighing less than seven. It was reported that the "Novelty" shot by the "Rocket" like a projectile.

Turning his attention again to the sea, Ericsson devoted the maturity of his years to the consideration of the utmost application of power in navigation. Submerged propellers occupied his whole thought for the year 1833. A few years later he met in Liverpool, Francis B. Ogden, United States Consul. Acclaimed already by a few scientific men of two countries, a third, the United States, soon sought the aid of his genius. Through Ogden the inventor met Robert F. Stockton, of the United States Navy. The Admiralty and the British naval engineers had not recognized the value of his screw propellers, but his ideas were instantly appreciated by the Americans. A small boat constructed with his latest equipment stood well the trial test on the Thames.

First Screw Propeller

This success resulted in an order from the United States for a small iron vessel fitted by Ericsson with engines and propellers. The ship reached New York in the fall of 1839, and a few months later her progenitor arrived to make New York his home. Many months followed before the government actually took measures to forward his innovations, but this period was fruitful of the introduction of his steam engine in this country and the construction of a screw-propeller warship, in type the forerunner of the *Monitor.* This was the celebrated *Princeton.*

Outstanding Inventions

On the occasion of the formal testing of the *Princeton,* which should be remembered as the first of modern warships equipped with power machinery below the water line, a serious misfortune befell the reputation of the inventor. Owing to Captain Stockton's rash judgment, a gun of too massive structure, though of the same calibre as the one ordered by Ericsson, was mounted and fired from the deck. The intended salute proved to be the hand of tragedy. A number of sailors and several inspecting officials were

killed in the explosion. For several years the name of the inventor was overcast.

A great number of inventions now crowded his years until the outbreak of the Civil War. From both their striking novelty and value they left a permanent foundation to his fame. In addition to the screw propeller were a steam boiler of artificial drafts which dispensed with smokestacks and effected an important saving in fuel; a steam fire engine; the caloric engine; a sliding telescope chimney; machinery to check the recoil of heavy guns; an instrument for measuring distance at sea; the hydrostatic gage for measuring the volume of fluids under pressure; a meter to measure the volume of water passing through pipes; an alarm barometer; a pyrometer to measure temperature from the freezing of water to the melting of iron; a lead to take soundings without rounding the ship to the wind; and various modifications of the caloric engine in which the expansive force of hot air was used as a source of power.

The success of the caloric engine brought the immediate support of the King of Sweden and recognition throughout the leading countries of Europe. Simultaneously prominent men of New York financed the building of the *Ericsson,* propelled by paddle wheels operated by a caloric system. Unfortunately, the vessel was lost on her second voyage.

"Monitor" vs. "Merrimac"

Disaster in the shape of the far-famed *Merrimac* overtook Union shipping during the first year of the Civil War. One by one this crude, iron-sheathed monster of the Confederate forces floated down on United States ships entering Hampton Roads. The timbersides of the Union Navy were no match for the ironclad. The administration considered the situation desperate. Ericsson was summoned to Washington. The keel of the *Monitor* was laid October 25, 1861; she was ready for action January 30, 1862. Two days after leaving New York Harbor she gave battle to the *Merrimac.*

"The cheese box on the raft" proved more than the equal of her larger opponent. From the single revolving turret amidships the gunners gave as well as they took; in fact they gave more. The smooth turning turret presented a poor mark as it fired at the bulky sides of the *Merrimac.* Then, too, she rode low in the water, her deck often covered by the waves. Finally disabled by a well aimed shot, she withdrew to shallow waters unbeaten and beyond pursuit. But the dread of the *Merrimac* was shattered.

Life Given to Work

Much has been said of the patriotism of Ericsson for his adopted country. That he chose the United States for the furtherance of his inventions and the prosecution of his discoveries is certain, and that he gave to this country liberally and unquestioningly is equally evident. But that, as the common belief runs, he took a very personal interest in the Civil War, or in any country, in fact, as highly improbable. He was mated to his science from his birth to his death. Toward the close of his life honors were showered upon him. Invited by the Crown Prince to visit the country of his birth, and later requested by the Department of State to attend as Commissioner the Universal Exhibition held at Paris, Ericsson declined, finding his experiments at home more absorbing. Rather than a patriot of either country, he was a builder of all time.

A true and active scientist and inventor till the end, he died in New York, where he had always lived since his arrival in the United States, on March 8, 1889. At the request of Sweden his body was returned to find a last resting place at Filipstad, in the locality of his birth.

Memorial Ceremony

Under the auspices of the American Society of Swedish Engineers the unveiling of a memorial statute to John Ericsson, erected on the Mall in Washington, took place on May 29, with leading personages of Sweden and America paying tribute to his achievements. President Coolidge, the Crown Prince and Princess Louise, Secretary Hoover, the Swedish Ambassador, ranking officers of the United States Navy, and many eminent engineers of both countries gathered for the ceremony.

Situated near the Lincoln Memorial, the granite monument presents a striking though dignified appearance. Its main execution is symbolical. The inventor is seated at the base. Above him are grouped figures personifying Vision, Adventure and Labor. Of masterful mien, these appear to keep the watch over him, as he sits wrapt in meditation. James Earle Fraser is the sculptor.

Unveiled By Prince

Owing to unfortunate delays in the progress of the work, the finished monument could not be got ready for the date scheduled for the unveiling. Parts of the basic pedestal and much in the details of the figures grouped above the seated inventor are still unfinished. In their place carefully made models were substituted for the occasion, as it was possible for the royal party and the large body of visiting delegates from the Swedish engineering and scientific societies to longer postpone their return to Sweden.

A United Tribute

Himself unveiling the monument, the future King of Sweden gave a short expression of his appreciation of the friendly union between Swedish and American engineers and scientists, stating that on such an occasion as this the homage given to the great inventor by representatives of both countries meeting jointly was a significant proof of the friendly spirit existing between the two peoples.

Banquet

In close connection with the unveiling in the afternoon, a banquet was held in the evening in the ball room of the Hotel New Willard, under the joint auspices of the American Society of Swedish Engineers and the Swedish Engineering Society of Chicago. The feature event of this session was the awarding of the John Ericsson Medal to Dr. Svante Arrhenius. Presented by Eric A. Lof, president of the American Society of Swedish Engineers, an official delegate received the medal for Dr. Arrhenius, who, due to illness, was unable to attend. Dr. Arrehenius, considered the father of electro-chemistry, was unanimously chosen as the first recipient of the award. He did much toward establishing the theory of the relations of the electrolytic phenomena to the chemical properties of substances.

What of the Filipinos?

Dearborn Independent, 26 June, 1926.—The chief plaint of the Filipino, in his present determined revolt against the suzerainty of the United States, is that the American people do not understand him and that they take little interest in the Philippines. He is "misunderstood," he declares, quite in the measure that the Americans themselves were misunderstood in their own struggle for independence. He defines his position as analagous to that of the Colonials in 1775. And he pleads that America do by him what the colonies would have been done by at that time.

Insofar as his accusation of indifference on the part of the American people is concerned, the Filipino has undoubted ground for dissatisfaction. How much, indeed, do we know about the Philippines? And further, how much do we care? Yet they are our possession and our responsibility,

as Kipling reminded us a quarter of a century ago when he wrote *The White Man's Burden*. In many ways we have not evaded that responsibility, as the economic development of the islands proves.

It would be an excellent thing both for the Philippines and for America if we knew a little more about the islands. Physically they are of matchless beauty and economically their worth is beyond computation. If we were to commence now to develop their productive possibilities, for example, along the one line of rubber growing, in six or seven years our rubber bill to England would be cut down hundreds of millions of dollars. And in a decade the Philippines could furnish us with almost if not quite all the rubber our nation needs. Nor is their potential productivity along other lines markedly less. If Hawaii has become a mighty economic asset, the Philippines, approximately as great in area as the whole of New Zealand, have equal possibilities. And they are to all intents and purposes undeveloped, great as has been the progress in the past thirty years. Except in Manila, life is largely as it was half a century ago or more.

In their possibilities of production of such staples as rubber and sugar the Philippines are of inestimable value to us. And that, also, is an excellent reason why what the Filipino people want is of interest and importance to America. We should know what they want and why they want it, to the end that we may be able to pass intelligently on their demands and that we may no longer be open to their accusation of indifference. Moreover, when we "took up the white man's burden" in the Philippines we assumed an obligation that was quite as heavy morally as it was politically or economically. That obligation requires us as a nation to interest ourselves in the welfare of the Filipinos as a people and to strive to understand them, whether we decide to yield to their demands or not. But frankness compels the statement that even the Filipinos do not know exactly what they want.

Last February I witnessed the Washington's Birthday celebration in the town where I was staying. My hotel faced the plaza, and from my window I observed the gathering crowds about the speakers' stand, the collection of twenty races, the colorful attire, the amazing blends of eastern peoples and European. The band played and the throng covered the plaza, upon which the sun blazed with tropical fervor. It was a half holiday, and the town took full advantage of it. Everyone was decked in holiday attire; even the children wore hugely uncomfortable shoes.

Was all this, then, a tribute to Washington, a sign of allegiance to the ideals and institutions of America? It was not! It was part and parcel of the agitation for Filipino independence. The day was set apart as a "day of prayer" and in every native church in the Philippines there was read a fixed prayer for independence, in which were embodied sentiments reflecting neither respectful allegiance to the United States nor admiration for any of its institutions. And in the plaza the native speakers harangued their fellow citizens in half a dozen dialects on the "neglect and indifference of our master, the American people!"

What, then, is it they want, these people whose aspirations were born only with the development of their intelligence through America's aid? That is not easy to say. Nor is it altogether certain that they themselves know. Indeed, that is the real weakness of their position. They do not want to separate altogether from America, one gathers; yet they want independence, or insist that they do. There is good reason to believe that they do not at all comprehend just what this means, and that they realize little or nothing of its responsibilities. They want independence and yet they do not want it. The more intelligent understand clearly that entire independence is by no means feasible, that their plight, left entirely to themselves, might become serious. Yet is is clear that all feel themselves entitled to a greater measure of self-government, or a sort of protectorate.

Cuba is, of course, their example. We gave Cuba independence. Why not the Philippines? Can we tell them they are not fit for it, and thus set them lower in the national scale than the Cubans? But they contend that we are doing that very thing by our refusal to heed their pleas.

The Filipino's attitude would be a good deal less truculent if he thought we had the requisite amount of interest in him. The trouble is that he is certain we are wholly indifferent. His newspapers, one of which is printed in English in Manila, stress continually the point that the average American cares little or nothing about the Filipinos, their needs or their desires. Are we altogether in a position to deny this accusation?

Much harm is done by persons spending a few hours in Manila, who assert that the islands should be independent, though they possess no knowledge whatever of the real condition. The other day a great liner tarried for a few hours in Manila, and one of her passengers, an Englishman, declared to the newspapermen that "England would have given the Filipinos independence ten years ago." This ridiculous assertion was immediately emblazoned on the front page of the Manila Filipino organ, and much stressed editorially.

I have found that the Filipino feels, or at least expresses, a good deal of respect for General Wood, though he resents the Governor General's attitude as to independence. The native also appreciates the employment of his people in official positions, quite as much as he appreciates many other things America has done for him, and he understands well the value of all those things.

I venture to say that, if a plebiscite were taken in the islands today on the question of complete independence or the largest possible measure of self government under the protection of the United States, the vote would be for the latter. But whether any greater measure of autonomy than at present exists is advisable remains a question.

The Next Disarmament Conference

Marine Journal, 19 June, 1926.—It is to be hoped that the unpopularity of arms that has been so ably fostered by our highly intellectual pacifists will not blind our delegates to the forthcoming world conference to facts which require only common sense to perceive. Economy and the preservation of peace throughout the world are not to be attained by saving the price of a few war ships, weakening our influence to maintain a balance of power that would be respected and permitting other nations to greatly outclass us in real sea power in ocean liners and other types of vessels that could be transformed overnight into an effective navy.

William Howard Gardner has presented some interesting figures regarding economy in our disbursement for arms in the current issue of the *North American Review*. He states that, "during the period from 1903 to 1924 our expenditures for armament, measured in terms of present day money, rose from $4.00 to nearly $6.00 per capita, while our other government expenditures multiplied from $24.00 to almost $86.00 per head, an increase of nearly $62.00." Basing his statements on figures published by the National Industrial Conference Board, Mr. Gardner makes the point that our tax burdens are due not so much to the often alleged "crushing burden of armaments" as to the orgy of spending, now prevalent in states and cities, and the consequent mounting of local taxation.

We should also like to point out that a very large part of our war obligations are the result of a lack of preparedness. Of course, there is the very plausible argument, that a well armed nation is not apt to be patient when difficulties arise and consequently it is apt to resort to conflict rather than reason. This is probably true for those countries whose ambitions are to establish a world empire, but no one believes either in this country

or abroad, that the people of the United States could be inveigled into war for any other purpose than self defense.

The ostensible object of disarmament conferences, of course, is the preservation of peace throughout the world by limiting the armed forces of the principal countries to such an extent and on such a ratio with each other that no one power can dominate the others. How this has worked out since the Washington Conference that evolved the famous 5-5-3 ratio is clearly set forth in an article by Professor Alfred H. Haag on another page of this issue.

As Mr. Gardner puts it, Continental Europe is occupied primarily with safeguarding its own borders and Great Britain's chief interest is in India and its communications leaving the maintenance of peace to a large extent particularly in the Orient up to the United States.

How vitally necessary our Navy and merchant marine are to our progress, prosperity and even safety are ably summed up by Mr. Gardner as follows:

"Although the central position of North America in the world of maritime trade is a potential advantage, the maintenance of our standard of living rests on our being assured of necessary imports, of markets open to our exports. If there is anything to be learned from history we should not rely on our competitors to collect our imports and deliver our exports for us. And we should not rely on sources of imports and markets for exports that are, in effect, under the shadow of our oversea competitors—unless, in turn, the latter can be controlled."

The general apathy that exists in the United States regarding the welfare of the American merchant marine is not a good omen that our delegates to the world conference have a proper grasp of the fact that any further reduction of naval ships will augment the sea power of countries having great fleets of commercial vessels. While the Orient, Russia, and even Mussolini are such unknown potentialities it is well for our representatives to remember that their high ideals may be easily nullified by another method of skinning the cat.

How Disarmament Has Worked

Marine Journal, 19 June, 1926.—The attention of the world is being focussed on the coming world conference for the further consideration of the Limitation of Arms, for which President Coolidge recently named the American delegates. The predecessor of this new conference was the famous Washington Arms Conference which was held here four years ago. That conference scrapped our most modern naval craft, which had cost this nation in excess of 330 million dollars. We believe that this policy was a humane one and intended for the good of the world at large, although it was a voluntary sacrifice of naval power unique in the history of the world.

However, when we permit our foreign competitors to dictate to us as to how we shall recondition our older type ships, and when we allow them to protest against our elevating the turret guns on our older vessels, for the purpose of bringing them up to the same range as the naval guns of other countries, the situation becomes incomprehensible and one that should ***not*** be tolerated.

The United States, which was then in a position to dictate terms, is now dominated and dictated to by the very nations to which we, for humanity's sake, endeavored to lend a helping hand. This is not all. The ultimate object of the Washington Conference was to enable the larger nations to curtail the building of naval tonnage, and particularly in reference to combatant vessels; its purpose was to help the nations to emerge from the chaotic conditions then existing, due to the wild and extravagant naval building competition.

Has this object been accomplished? Let us investigate the status of those nations with regard to their naval activities, today—four years after the Washington Conference. Referring to vessels laid down or appropriated for during the period between the Washington Conference and October 1, 1925, we find that the United States has no battleships of the first line, while the British Empire, under the terms of the conference treaty, has two. Light cruisers of the first line, the United States 2, the British Empire 11, Japan 12, France 6, and Italy 2. Destroyer leaders: France 9, other countries none. Destroyers: the United States none, the British Empire 2, Japan 35, France 22, and Italy 16. Submarines, all classes: the United States 3, the British Empire 3, Japan 30, France 32, and Italy 12. Gunboats: the United States 6, the British Empire 4, Japan 4.

With reference to light cruisers, of the first line, carrying from 5 to 8-inch guns, from 3 to 10,000 tons displacement, with a speed of 27 knots or more, there are built or building, for the United States 12 of 95,000 tons; the British Empire, 51 of 300,000 tons; Japan, 25 of 150,000 tons.

Cruiser Strength

Regarding the cruisers' strength, take into consideration the second line or older type ships, paying particular attention to the dates of completion, the effective life of a cruiser being approximately fifteen years, of these the United States has 11, of approximately 50,000 tons, completed in the years from 1895 to 1908; the British Empire has 12, of 64,000 tons, completed during 1911 to 1922; Japan has 6 of 27,000 tons, completed between 1899 and 1912. With the cessation of the building of battle cruisers which were designed for a speed of 35 knots, the importance of first line cruisers becomes evident. In hostile times they are decidedly dangerous, among other things, to merchant shipping, remembering the havoc wrought by the few German cruisers at liberty on the high seas. The situation of the first line cruisers deserves serious attention; the next reference is decidedly interesting. Modern combatant ships actually under construction: The United States has 7, of 80,000 tons; the British Empire 17, of 200,000 tons; Japan 36, of 163,000 tons; France 54, of 131,000 tons, and Italy 48, of 63,000 tons.

With the continuance of a building program of combatant vessels resulting in this disproportionate ratio, one asks: Was there anything gained by the United States sacrificing her modern battleships and battle cruisers, consisting over a half million of tons actually under construction, in contrast with the four *projected* ships of the British Empire? Japan in this instance scrapped four ships of 160,000 tons which were under construction. Of the capital ships which were completed, the United States scrapped nineteen of approximately 300,000 tons; the British Empire, twenty-two ships of approximately 450,000 tons; while Japan scrapped twelve ships of approximately 200,000 tons. In other words, the United States sacrificed thirty-two capital ships, built and building, amounting to almost a million tons, the British Empire scrapping twenty-two ships of less than a half million tons, and cancelling four projected ships.

Lignite Mines of North Dakota

Christian Science Monitor, 10 June, 1926.—Under the prairies in western North Dakota are millions of tons of lignite coal waiting to be noticed. The farmers of that section have known this fact for years, and have shoveled their winter's supply of coal from the side of a hill, attracted by the many surface veins of lignite streaking the buttes. Some men of vision have opened mines, realizing the possibilities of furnishing that whole western section with coal. Mining however, takes capital, and while there are about 260 mines in operation in North Dakota, most of them are on a very small

scale, and only a few are able to approach in any way the efficiency of eastern mines in output, advertising, or marketing ability.

Outside Capital

The last years, which have brought a continuously unsettled coal situation with strikes or impending strikes and threatened coal shortage, have called attention to these mines; have shown the people of North Dakota what treasures lie under the prairie, and have even attracted outside capital for investment.

That North Dakotans have failed heretofore to make use of their lignite fields to any marked degree is due to the newness of the state, the recent agricultural depression, and the meager amount of capital available in comparison with that at the command of eastern industries. The development of the lignite industry has undoubtedly been discouraged by the powerful and well-organized bituminous and anthracite coal companies and allied interests of the East, which for years have been supplying the northwest with coal at high prices. Moreover, the demand for a more economically sound distribution of coal has not yet made itself sufficiently felt.

Of National Concern

It may seem that the development of the lignite industry concerns the people of North Dakota alone. This, however, is not true. The economic problem presented by these vast lignite resources is one of national significance. At present millions are being wasted in unnecessary freight bills for the transportation of eastern coal to midwestern markets. Millions are being wasted in the unnecessary movement of freight cars to carry that coal. At the same time coal is often diverted from eastern industries. This in itself in times when a coal shortage is threatened is a factor to be reckoned with. Even home consumption in New England and other localities, somewhat removed from the mines, is affected by prohibitive prices, if not by actual shortage. On the other hand, Minnesota, North and South Dakota, and neighboring states are spending more on coal from the East than can be realized from their wheat crops. They also are borrowing heavily from the East to finance their farming. This balance must eventually be adjusted.

It is not generally known just what immense deposits of lignite lie dormant under the prairies. One-third of the coal deposits of the United States are to be found in North Dakota. To carry comparisons further, to give some adequate idea of the great undeveloped resources of North Dakota, it has been estimated that the coal deposits of England, Germany, and France combined are almost equaled by North Dakota.

What It Is

Lignite is a quality of coal between peat and bituminous. While it is easily mined, there being many surface veins from which coal can be taken with steam shovels, yet considerable capital is necessary to present it to the public in a desirable form for home consumption and industrial use. It can be used in a great variety of stoves, heating plants, and power plants in the form in which it comes from the mine. However, it is very volatile, and ways and means must be evolved to eliminate waste. The making of briquettes is continually being perfected. In this form lignite is clean and convenient to handle. Properly made briquettes are strong enough to stand the wear of transportation and weather conditions, and have a heating value twice that of an equal amount of anthracite or bituminous coal. A pulverizing process needs to be more adequately developed in order to make lignite practical for industrial use. Since there is great danger of explosion when lignite is stored for any length of time in pulverized form, a process

must be perfected by which it can be pulverized just as it is needed for use in various industries. The Great Northern Railroad has done considerable experimenting with the pulverizing of lignite, in order to be able to use it in the road's boiler shops in North Dakota and eastern Montana and for fueling locomotives in this territory, instead of depending on soft coal from the head of the Great Lakes.

The labor situation among North Dakota miners has been tranquil over a period of years. There seems to be a good understanding between miners and operators. The miners are well paid. Few work under union rules.

Lignite sells for about $2 a ton at the mine and $5 retail. This difference is due to high freight rates. Briquets sell as high as $11 a ton. As cheaper and more efficient mining methods are adopted and the selling price of lignite is kept low in comparison with eastern coal, an ever widening market will open up.

North Dakota benefited from the last coal strike. Mine owners, who felt that this strike was impending, made preparations for increased output, realizing that this was an exceptional opportunity to widen the market for North Dakota lignite.

Perhaps the greatest enthusiast for the development of the lignite industry is Major Stanley Washburn, who is well known as a soldier and war correspondent. His family has been influential in building up the Northwest. The Washburn Lignite Coal Company at Wilton, North Dakota, operates the largest lignite mine in the world. Its daily output has been about 3000 tons and its employees number about 400. Major Washburn has done his best to arouse the North Dakota lignite operators to their opportunity in the present situation.

By-Products

The possibilities in the development of these lignite resources are far reaching. Not only is the supply of coal under the prairies practically inexhaustible, but the subsidiary industries which can be established in connection with the mining of coal forecast a great future for the ingenious business man. To every ton of lignite there are 10,000 cubic feet of gas of a quality of high heating value. The possibilities in making use of this are very great. Petroleum oils are also found in lignite. In fact, lignite is considered by some to contain more oil than Colorado shale. Other by-products of lignite are ammonia and tar. Refrigeration, nitrogen products and fertilizer can be developed from the ammonia. Further experimentation and distillation of the byproducts will reveal increasing opportunities for manufacture.

It will be interesting to watch the development of North Dakota in the next ten or twenty years. Will that prairie state, now known primarily for its wheat crop and the Non-Partisan League, become one of the great industrial states of the Union? Besides the vast beds of lignite which open the way for manufacture and huge electric superpower systems, there are indications of oil in several parts of the state. Excellent transportation facilities are offered by three large railway systems. The opportunities are great for men of vision.

CURRENT PROFESSIONAL NOTES AND PAPERS

"Lost Battalion of the 77th Division." By Capt. Hurly E. Fuller. *Infantry Journal*, June 26.

"Limiting Factors in Reducing Excess Air in Boiler Furnaces." *Mechanical Engineering*, July.

"Education and the Employee." *The Engineer*, June 18.

"The Great Shipping Problem," *Marine Journal*, June 26, 1926.

"A Comparison of Foreign and American Seagoing Tugs." *Nautical Gazette,* June 26.

"There is Nothing New Under the Sun." Prototypes of modern weapons. *Journal of the Royal United Service Institution,* May, 1926.

"How to Lay Out Power Plant Piping." *Power,* June 22.

"Aerial Armament and Disarmament." Edward P. Warner, *Foreign Affairs,* July.

"The Future of the League." By A. Lawrence Lowell, *Foreign Affairs,* July.

Signal Wiring, by T. Croft. A book dealing largely with circuit diagrams.

A Pocketbook of Ship Materials and their Uses, by H. H. Thayer.

"A Practical Method for Determining Ocean Currents," (pamphlet) by U. S. Coast Guard.

"A New Electric Drive for Ship and Other Auxiliaries." Gilbert Austin.

"The Further Development of Large Power Diesel Engines." W. D. McLaren.

"On the Longitudinal Strength of Ships." T. R. Thomas.

"The Latest Type of the Burmeister and Wain Marine Diesel Engine." H. H. Blache.

"Steam Pipes for Extra High Pressure and Temperature." J. A. Aiton.

"The Manufacture of Brass Condenser Tubes, With Some Notes on an Alternative Alloy." G. H. Whiteman and A. Spittle.

"The Internal-Combustion Turbine." Prof. W. J. Goudie.

NOTES ON INTERNATIONAL AFFAIRS

FROM JUNE 3 TO JULY 3

PREPARED BY

PROFESSOR ALLAN WESTCOTT, U. S. NAVAL ACADEMY

UNITED STATES AND LATIN AMERICA

TACNA-ARICA PLEBISCITE ABANDONED.—At the close of June the American representative, General Lassiter, presented to the Tacna-Arica Plebiscite Commission a motion that "a free and fair plebiscite, as required by the award, is impracticable of accomplishment." This motion was adopted by the votes of the United States and Peru, Chili opposing. Subsequently General Lassiter and his staff boarded the U.S.S. *Galveston* and proceeded to the United States. The Chilean Ambassador in Washington informed Secretary of State Kellogg that his government considered General Lassiter's conduct "illegal and exceeding the powers vested in him," and that Chili would no longer take part in the informal negotiations instituted at Washington by Secretary Kellogg.

Unquestionably the United States has lost a certain amount of prestige in Latin America through the failure of negotiations thus far. The United States' position was sufficiently set forth by General Lassiter in his speech to the plebiscitary commission, released at Washington last week: "Flagrant as have been the outrages to which Peruvian electors and sympathizers have been subjected and pitiful as have been the sufferings of the helpless victims it is not these outrages themselves that in my opinion have constituted the most serious phase of the long continued course of violence, oppression, persecution and discrimination that has marked the past year in this territory.

"The vital factor in the situation has been the attitude of the Chilean authorities as shown conclusively by their continued failure to take adequate action to secure to Peruvians the due and equal protection of the law or a reasonably free and equal opportunity for the exercise of plebiscitary rights."—*Time*, 28 June.

CANADIAN CHANGE OF GOVERNMENT.—Since the parliamentary elections in Canada last October the Liberal Ministry headed by Mackenzie King has had a precarious existence, with only 101 Liberal votes and dependent upon the 28 Progressive and Independent members to overcome the 116 votes of the Conservative party.

On June 28, as a result of the revelation of extensive corruption in customs administration, the Ministry was defeated and forced to resign, after the refusal of Governor General Byng to dissolve parliament and call a new election. Arthur Meighen, former premier and conservative leader, organized a new cabinet, but was soon defeated, and parliament was

dissolved for a new election. There was much Liberal criticism of Governor General Byng's refusal to call an election at once upon the defeat of the Liberal government.

LEAGUE OF NATIONS

BRAZIL AND SPAIN THREATEN WITHDRAWAL.—The struggle of Brazil and Spain for permanent seats in the League of Nations Council reached a climax at the Council meeting which opened on June 7. To this meeting Spain sent only a minor official, and, subsequently, without definitely stating her intention to withdraw from the League, declared that unless Spain were accorded a permanent Council seat she would send no delegate to the September Assembly.

The Brazilian representative, Dr. De Mello Franco, at first absented himself from the meeting and then handed to the League secretary a telegram from his government indicating Brazil's intention to withdraw from the League. In a later note the Brazilian government bitterly criticized the conduct of the League, condemned the limitation of permanent Council seats to the great military powers, and objected to alleged dictation by these powers as to the composition of the Council.

Friends of the League consoled themselves with the thought that the action of Spain and Brazil would at least facilitate the admission of Germany with a permanent Council seat in September. Furthermore, the withdrawal of Spain was only tentative, and the action of Brazil might be reversed by the new president of Brazil who takes office in October.

WORK OF DISARMAMENT COMMISSION.—The technical military committee of the Preparatory Disarmament Commission continued its work during June, and by the end of the month the sub-committees of experts on land, naval, and air armaments were preparing reports for a plenary session of the military committee, after which the committee planned a three-week recess. Little progress was made; the delegates were dominated by the interests of the particular nations which they represented; and the efforts of some at least appeared to be directed chiefly toward preventing a final report before the League Assembly in September and the admission of Germany, France, supported by Italy and by some of the smaller powers, opposed the separate consideration of air, land, and naval armaments, and also insisted that all the "potential" resources of countries must be considered in measuring their military strength.

In the Baltimore *Sun* of 30 June appeared the following summary of proposals favored by the United States delegates which were rejected:

Thus far, not a single proposal advanced by the Americans has been accepted.

First, the commission voted that total tonnage only be considered for the determination of the strength of the navies.

Second, it rejected consideration by classes, which was the dominating principle of the Washington naval pact.

Third, it threw out consideration of trained reserves or material war stocks as factors in ascertaining the war strength of armies.

Fourth, it rejected the American viewpoint that air establishments should not be limited commercially by deciding the air strength of a country should be based upon the total horsepower of its airplanes and the cubic capacity of its dirigibles.

Fifth, it refused to treat disarmament in separate categories.

Lastly, it decided, despite the opposition of the United States, to take three weeks' vacation, throwing the deliberations into August, when less than a month intervenes before the September assembly when readjournment is inevitable.

DECISIONS REACHED.—By the middle of June the Military Committee had reached agreement that "theoretical" limitation might be looked for in the following fields: (1) Land, sea, and air effectives constantly available; (2) length of voluntary or compulsory service; (3) war materials in use or in stock; (4) expenditure on training and in cost of armament materials as a whole; (5) chemical preparations; (6) aeronautical preparations; (7) preparations for utilizing the merchant marine for war; (8) industrial preparations in general. These were "theoretical," not necessarily "practical."

In its final conclusions about "standards by which land armaments may be compared" the land sub-committee finally decided that "ultimate" war armaments lend themselves to approximate comparison and should be taken into account; that trained effectives constitute the primary standard, but that they must be considered in conjunction with other factors, namely, materials in service and in stock, trained reserves, the number and composition of larger peace-time units, periods of service with the colors, and the time and organization required for complete mobilization of national resources.

In the naval sub-committee the Franco-Italian bloc secured the decision that comparison can be based only on total tonnage of fleets and not in tonnage by classes. This, it was decided, applied also to reserve ships, constituting "naval materials." Only the United States, Great Britain, and Chili voted against this last decision, eleven nations voting in all. The United States delegation submitted a minority report making clear their objections to these decisions, and to the settlement of naval questions by nations without navies or even seacoast. This minority report was supported also by Great Britain, Chili, and Argentina, but was rejected by the full committee.

POPULATION AND WAR.—(From Problems of Over-Population, by E. M. East, Professor at Harvard, in July *Current History*) "In the first decade of the twentieth century Germany was the danger spot of Europe. Her growth was too rapid. Today this possibility has been eliminated by the decreased birth rate of the new German Republic. Italy has taken her place. Tomorrow or the next day, Russia will replace Italy."

GREAT BRITAIN

ANGLO-TURKISH TREATY.—On June 5, by signing a treaty with Great Britain, Turkey finally accepted a settlement of the Mosul dispute prac-

tically in accord with the decisions made by the League Council. The main terms of the treaty are: (1) That the "Brussels line" shall be accepted as the frontier between Irak and Turkey; (2) that Turkey shall receive ten per cent of the revenues from the oil fields in the Mosul region and also in other parts of Irak for a period of twenty-five years.

Press reports suggested that Turkey was induced to accept these terms partly because of possible dangers threatening from Italy and Greece, and partly because of the prospects offered of immediate revenue, in view of the approaching completion of the Mosul pipe line and the likelihood of increased oil yields.

BRITISH ASSERT CONTROL IN EGYPT.—In spite of a parliamentary majority of 166 out of 215 as a result of the recent elections, the Wafd or Nationalist Party in Egypt was unable to form a ministry with its old leader, Zaghlul Pasha as Premier. Zaghlul refused to promise respect for the "four rights" of Great Britain in Egypt, namely, retention of the Sudan, British army of occupation to protect Suez, British protection against foreign aggression, and British protection of foreign citizens and interests in Egypt. Hence the British representative, Baron Ambrose Lloyd, forced him to withdraw in favor of the moderate leader, Adli Pasha.

PROTEST AT SOVIET GIFT TO BRITISH LABOR.—In what turned out to be a mildly worded note, the British government early in June protested to the Soviet government against their allowing funds to go out of the country for the aid of British labor in an illegal general strike. The note did not contend that the Soviet government had actually sent the funds, but objected to the relaxation in favor of the strikers of the Soviet law against export of money.

In the British House of Commons there were violent attacks upon the Soviet government and agitation for breaking off relations, but Foreign Secretary Chamberlain stated that such action was not contemplated at present. The Russian money came from trade union sources; it was reported on June 10 that £30,000 more had been given, and also £10,000 from United States unions.

TRADE WITH RUSSIA.—According to Soviet figures, British trade with Russia has greatly increased since 1922. United States trade with Russia has also increased from $41,000,000 exports and $8,000,000 imports in 1924 to $68,000,000 exports and $12,600,000 imports in 1925.

GERMANY AND EASTERN EUROPE

ROYAL PROPERTY CONFISCATION FAILS.—The national referendum in Germany on June 20 on the proposal to confiscate the property of former royal families resulted in the defeat of the proposal by abstention of its opponents from voting. About 14,500,000 votes were cast for the measure and only 600,000 against, but about 20,000,000 votes were necessary to constitute one-half the total electorate and make the decision valid. The confiscation was most strongly supported by the Socialist and city vote.

Much excitement was caused by publication prior to the election of a private letter from President von Hindenburg strongly condemning the measure as "an attack on legal rights and morals."

PILSUDSKI'S AIMS IN POLAND.—After refusing the office of President of Poland as a result of the election at the end of May, Marshal Pilsudski took for himself the post of Minister of War in the Bartel cabinet, carrying with it complete control of the Polish army and practically dictatorial powers. On June 23 the Diet was forced to adjourn until July, when it will be called upon to adopt reform measures approved by the Pilsudski régime. These will include reduction of the Diet from 555 to about 300 members, advance of the voting age to 24 as a thrust against the Communist "youth" movement, and another measure to penalize candidates who receive less than 1,000 votes in an election, and thus reduce the present unwieldy number of twenty-two parties.

LITTLE ENTENTE CONFERENCE OFF.—A conference of the foreign ministers of Czechoslovakia, Jugo-slavia, and Rumania was to have taken place early in June in Jugo-slavia. The program included discussion of the increasing rivalry between France and Italy for dominant influence in the Little Entente, and also proposals for abolition of customs control between the countries, the long-standing problems arising from Hungarian monarchical tendencies, and the recent Russo-German treaty. The meeting, however, was postponed owing to a political crisis in Czechoslovakia which forced the return of Foreign Minister Benes.

FRANCE

CAILLAUX IN REORGANIZED MINISTRY.—The Briand government fell on June 15 following the continued decline of the franc and the resignation of Finance Minister Peret. There was some talk of a coalition ministry; but after Herriot and Poincaré had refused to serve under Briand, and after Herriot had failed to organize a ministry of his own, the veteran Briand again came into power as head of his tenth cabinet. This depended for its strength chiefly on the re-appointment of Caillaux as Minister of Finance. One of the first acts of the new government was to oust Robineau as President of the Bank of France, and there was some talk of efforts to secure modification of the debt agreement with the United States. However, on June 25 the Expert Finance Commission appointed by Peret reported in favor of ratifying the debt agreement as it is, as an essential first step toward stabilization of the franc and improvement of finances.

The new cabinet received a vote of confidence of 290 to 130, the Right not voting. The real test was expected on July 6, when M. Caillaux would outline his financial plans.

LEAGUE APPROVES FRENCH RULE IN SYRIA. New York *Times*, 18 June. Geneva, June 17.—Approval of the French administration in Syria was voiced by the League of Nations Mandates Commission following a report today by Senator Henri de Jouvenel, the High Commissioner of the man-

dated territory. The endorsement of the commission is equivalent to a vote of confidence by the League in the work of de Jouvenel, and means that the question of French rule in Syria will not come up again before the League until October, when the Governmental report will be examined.

M. de Jouvenel replied in detail to the seven charges of the Syrian Nationalists against the French Administration. He defended the Syrian-Turkish Convention, the French action in Damascus, the French police work, the establishment of the Republic of Lebanon and the use of forces against the Djebel Druse tribe, and answered charges that people were executed without trial and of brutality to prisoners and civilians.

He said that the greatest opponent to the French administration in Syria was "Prince" Lotfallah, who, he said, was neither Syrian, Palestinian nor prince. If he wished to speak in the name of the Syrians he should start out by becoming one, said M. de Jouvenel.

CHINA

LEADERS MEET AT PEKING.—Chang Tso-lin entered Peking on June 27, and was reported to have from 35,000 to 50,000 troops in the city as a body guard. He was met there on the next day by Marshal Wu Pei-fu.

The prospect that the forces of these leaders would be able to overcome the Kuominchun or National Army appeared by no means assured, since the latter had about 200,000 troops in the field well provided with food and munitions from Russia and quite capable of holding their own indefinitely in Northwest China. On the other hand, new leaders among his own forces threatened the control of Wu Pei-fu.

BOOK REVIEWS

BALLOON AND AIRSHIP GASES. By Lieutenant Colonel Charles de F. Chandler, U. S. Army, Ret., and Lieutenant Walter S. Diehl, (CC), U. S. Navy. The Ronald Press Co., New York.

In these days when, to most of the general public, aviation means airplanes, any well written and informative book relating to airships or lighter-than-air craft is most welcome. *Balloon and Airship Gases* is in reality, two books under one cover and each part will be treated separately.

Part I

To an executive in a country where helium is yet a scientific luxury, the first part will be of some value. The practical hydrogen plant operator will find little solace in time of need when the plant is not putting out.

The various methods which have been used to produce balloon hydrogen are mentioned and the three most important ones each receive a full chapter. In spite of this lengthy treatment the data and descriptive matter would be of very little value to the plant operator.

In the first six chapters dealing almost exclusively with hydrogen many errors, some probably typographical, appear. Keyes' Equation of State for Hydrogen is misquoted although correctly given in Part II. On page 23 the author gives the accuracy of the effusion method for determining the purity of a gas, as within 0.2 to 0.3 of the correct figure; whereas in the standard field apparatus illustrated on page 19, an accuracy of plus or minus one per cent is all that can be relied upon. As an indicator to detect the presence of carbon dioxide, barium hydroxide was probably meant instead of potassium hydroxide in order to obtain the indication described.

Having devoted sixty-four pages to hydrogen of which the author appears to have some general knowledge, he passes on to the subject of helium. Here again Keyes' Equation of State is misquoted. This is followed by five pages principally copied from *U.S. Geological Survey* Professional Paper #121, of material on the occurrence of helium in natural gas and the Cady method of analysis.

The description of the United States helium plant sounds like a catalogue of a compressor manufacturer. Why the author copied this portion of a report by the Bureau of Yards and Docks instead of one of several other articles which have been published and which give a far better description of the process and its underlying principles, is one of the several mysteries of the book.

In regard to the Navy Helium Purification Plant at Lakehurst, there was no reason why the author should not have given a rather complete description of the theory and the apparatus, instead of merely devoting one-half page to this most important feature. The plea of secrecy will not apply for that was completely destroyed by the publication of the Flow Sheet on page 84. Also one must take issue that the process requires only one thermo-cycle, for on page 84 two cycles are plainly evident.

To the most important subject of "Storage and Transportation of Gases" the author devotes only a few words, and most of those to gas-holders with which most people are more or less familiar. During the World War the Germans were years ahead of everyone else in the storage and transportation of gas in high pressure tanks. It was their success and not that of the British which led to the procurement of the high pressure storage for Lakehurst in 1923 from the Bethlehem Steel Company on a very general specification put out by the Bureau of Aeronautics. The design and development of these cylinders were made by the Bethlehem Steel Company and the reproduction of that company's detail drawing by the author without stated permission or proper acknowledgment is, at least, in bad taste.

Based on the experience thus obtained the Bethlehem Steel Company, working with the gas officer at Lakehurst, in the fall of 1923, evolved the Helium tank car for the transportation of helium. Due to the lack of funds the Navy surrendered its rights in this design to the Army so that the Bethlehem Steel Company could proceed with the construction of the first gas tank car.

Again in Chapter 9, we find the capacity of cylinders is given only for hydrogen and no mention of helium appears although there is a considerable variation in the two gases. The treatment of the compression of gases means little as everything is on a theoretical basis and the curves and tables given require the application of the practical factor before they are useful.

Next to the transportation and storage of gases the most important factor is inflation and deflation of ships and the discharging of cylinders. Yet this is slurred over in a few words after chapters had been devoted to obsolete hydrogen processes. The treatment of this factor, covered in Chapter XI, is based on 1917 practice and is so completely obsolete as to be of practically no value in 1926.

The author may be willing to fill free balloons from impure hydrogen purged from an airship, but most practical flyers have a more wholesome respect for such procedure. Again if the balloon officer permits a bag inflated with hydrogen to take up 36 per cent of air he had best make his will and load up with life insurance.

A considerable portion of the information contained in Part I of this book was copied almost verbatim from pamphlets, information circulars and manuals issued during the World War, which probably accounts for the inclusion of so much obsolete material and the preponderance of hydrogen

over helium even in sections common to both and to which the plea of secrecy cannot be applied.

PART II

The section of Physics of Gases by Lieutenant Diehl is very capably handled and contains sufficient thermodynamics to handle most problems arising in Aerostation. However, it is believed that a person not conversant with thermodynamics, will find the treatment too condensed to be of much assistance.

The appendix is an excellent collection, in one place, of all kinds of data necessary for calculations. Most of the data is given in English engineering units as well as in the scientific units. It is regretted that the author did not do the same with Table 10—Keyes' Equation of State for Common Gases.

Z. W. W.

THE DARDANELLES EXPEDITION. By Captain W. D. Puleston. U. S. Naval Institute. $2.50.

REVIEWED BY MAJOR SHERMAN MILES, (C.A.C.) U. S. ARMY

This is an excellent study of the naval operations at the Dardanelles, illustrated with sixty-eight admirable charts. Since it was written in the light of Sir Julian Corbett's volume which deals with these operations, as well as all other studies which have been made on them, it is probably the most accurate and concise account of the naval attacks, and of the effect of naval fire on forts and seacoast artillery fire on ships.

I doubt Captain Puleston's statement that the real reason for the expedition was England's dread of losses on the French Front. His chart on page 11 shows graphically the enormous advantages which the Allies would have gained could they have forced the Turkish Straits. It was one of the two possible ways around the unbreakable deadlock on the Western Front. The other way around—Lord Fisher's pet Baltic scheme—did not offer protection to the Suez or India, or great moral effect of victory on the Near East, or the direct gain involved in putting Turkey out of the war and probably bringing Italy, Bulgaria, Greece and Roumania in on the Allied side.

These stakes, together with the others shown on page 11, were so high that I think, in seeking the basic reasons for the campaign, we need not fall back on any craven fear of losses.

That the conception of the campaign was both brilliant and sound Captain Puleston does not apparently doubt. That it grew, like Topsy, from Lord Kitchener's offhand commitment to Russia on January 3, is another matter. I think Captain Puleston, in drawing up a lesson for American statesmen, sailors and soldiers, fails to emphasize sufficiently the utter lack of coordinated planning for such an expedition, and the extraordinarily offhand methods which served for army-navy cooperation before and during the campaign.

The disappointing part of Captain Puleston's admirable study lies in the fact that, after dedicating it to General Ely for his work on army-navy cooperation, he fails to emphasize the lack of such cooperation at the Dardanelles and in London, or to indicate clearly what should have been done to secure it. There is little said about Lord Kitchener's vacillation; the inexcusable mistakes in loading and equipping the military expedition are not mentioned. There is nothing said about Admiral DeRobeck's inertia during the month which General Hamilton was forced to spend in reorganizing his ill-equipped forces in Egypt. No mention is made of DeRobeck's failure to use his fleet and his greatly improved mine sweeping flotilla when and after the army landed. No point is made of the indirect influence of naval ideas on Hamilton's landing plans, or of the failure of the fleet to carry out their implied part in the joint operations. Nothing is said about the effect of naval fire on Turkish field troops, and very little on the grave mistake of the fleet in landing the Anzac Corps at the wrong beach. Nor is it brought out that naval influence was largely accountable for Hamilton's unfortunate diversion of an army corps in the useless landing at Suvla. Above all no stress is laid on the two fatal omissions of the campaign—the lack of a joint Army-Navy planning staff in London and the lack of unity of command at the Dardanelles. Nor are the Turkish sins of omission along similar lines mentioned.

The army-navy cooperation which comes from joint and laborious planning and from unity of command at the point of attack or defense can never be attained by us until we put our fingers on the basic causes on our own and other people's errors in the past, and indoctrinate ourselves, and then our political superiors, in the scientific and unified methods of attack and defense. Captain Puleston lays the principal blame for the Allied failure at the Dardanelles on Winston Churchill, First Lord of the Admiralty. He doubts "if even Great Britain could survive another World War and another Churchill." We of the army are more hardened to political interference in the conduct of war than are our naval colleagues. We would, perhaps, not be so prone as they to attribute the principal blame for the Dardanelles failure to a naval secretary whose real fault lay, after all, in over-zealousness in pushing the army and navy into a campaign they should have undertaken on their own initiative. For I think it cannot be doubted that this campaign offered stakes more than commensurate with the effort involved. And since it is fairly obvious that a properly organized joint attack would have succeeded in mid-March, and that the actual attack (not joint) came within an ace of succeeding as late as August, it is fair to say that the campaign conceived in January-February offered no insurmountable obstacles to the Allies. This being so, it is hard to see why the principal blame should attach to Churchill. A naval secretary is surely not alone accountable for utter lack of joint planning, for vacillation and mismanagement in the War Department, for lack of cooperation on the joint front or anything like unity of command, or even for the supineness of his admirals. I think that we of the army and navy would do better to take to heart the glaring errors and omissions of the military and naval commanders directly or indirectly responsible for the Dardanelles failure.

When we are quite sure that we have learned that lesson, and by its help have set our own houses in order, we will be in a better position to preach to civilian authorities on the text of the over-zealousness of Winston Churchill.

THE INTIMATE PAPERS OF COLONEL HOUSE. Arranged as a narrative by Charles Seymour, Professor of History, Yale University. Houghton Mifflin Company, New York. 2 vols. $10.

The publication of these papers throws additional light on the relations of the United States with the European belligerents while still a neutral, and they will be better understood if compared with Grey's *Twenty Five Years* and Page's *Letters*. The papers are bound to prove interesting to Americans for they are as much concerned with our domestic affairs as with our European relations. They raise some very curious questions about the conduct of our government during the Wilson administration which will not be satisfactorily answered until the literary executors of President Wilson publish his letters.

The arranger of the papers, as if frightened by their early publication while many of the principal actors are still alive, explains Colonel House's reasons for immediate publication. There is still another reason for immediate publication and that was the lack of interest shown by the succeeding generation in Metternich's memoirs which he had scrupulously and rather conceitedly sealed for twenty five years after his death. When they were published an indifferent public ignored them, yet in his time Metternich played as conspicuous a part in his World War as did the silent Texan; and Metternich played his part in his own right and in the spotlight of the throne room.

The arrangement of the papers is not particularly convenient for the casual reader who must be alert to avoid confusing Colonel House's diary with his remarks made some years later or even with comments of the arranger. This difficulty perhaps was unavoidable in reducing the papers to a narrative.

In 1912 House, recovering from an illness, wrote a novel, *Philip Dru*, in a vain effort to change our constitution. He used the fictional form of appeal because he doubted there would be readers if he wrote in a more serious vein. He used the time sanctified plot of the poor young man falling in love with the daughter of a plutocrat, who of course returns his affection and then both of them devote their time to settlement work. House enlarges the plot by inspiring his hero to start a revolution which overthrew our government and substituted a dictatorship. House (alias Philip Dru) then remodels our constitution into a socialized British constitution, with particular attention to details usually left by common consent to individual taste; but House proposed to regulate every activity from birth to burial and advocated government control of scandal mongers as in the days of the Puritans. Bryan and Lane testify that many of the views of Philip

Dru were adopted by our government, and it is well known that President Wilson regarded himself as the leader of the democratic party while President. However, this was no new idea as Roosevelt had exercised leadership of his party when President. The theme of *Philip Dru* is that money power will rule the country unless a benevolent despot can be found who will protect the common people. Money-bag rule, or a Mussolini, is the Colonel's idea of the fate of the people of the United States whom he apparently considered unable to govern themselves.

Being an author House admits in his preface to the papers that he could have arranged them but he feared he might unconsciously turn them into an apologia. After reading his notes few readers will share the Colonel's fear. But if his object were to avoid an "apologia" his selection of Seymour was a wise one for the only apologies made by Seymour are for Wilson.

It will be necessary to note some of the biographical qualifications of Professor Seymour before endeavoring to obtain a true picture of the relation ship which existed between House and Wilson, for this relationship is only glimpsed through Seymour's eyes.

Among Seymour's remarks of House are the following:

for Col. House was as coldly objective in judging himself as another.

Col. House's desire to escape publicity arose in part from a sardonic sense of humor which was tickled by the thought that he, unseen and often unsuspected, without great wealth or office, merely through the power of personality and good sense, was actually deflecting the currents of history.

The path which House laid out for himself was entirely untrodden, and it is fruitless to seek an historical parallel. Monarchs had shared their secrets with father confessors; presidents had created their kitchen cabinets. But neither the one or the other suggests the unofficial functions which House exercised.

He longed to play an influential if not decisive rôle in politics—to inspire in the people a more sensible view of their welfare; above all to hasten the advent of a system which would protect the weak—from exploitation by the strong. Even as a boy there was in him something of Louis Blanc and Mazzini, strictly controlled, however, by an acute sense of the practical that recalls Benjamin Franklin. His ambition led him to seek accomplishment rather than notoriety.

There may be people in the world who can judge themselves as objectively as others but they have escaped high place, public scrutiny and searching examination. British history furnished so many parallels to Colonel House that in Great Britain it became the custom to behead the favorites because in theory the King could do no wrong and the sturdy British sense of justice therefore found it necessary to reach behind the throne and uncover the unoffical adviser, who was misleading an unsuspecting king. In modern and softer times the British constitution forbade any one not enjoying the confidence of the House of Commons from advising the throne. The monarchs of Europe have been so prone to favorites and confidential advisers that it has passed into a proverb: Shakespeare warned favorites against the ingratitude of the throne, Bacon explains the reason kings must have favorites: William III, whose Dutch favorite

almost cost him his British crown, twitted his rival, Louis the Magnificent, not for having a confidant, but for having "a young confidant and an old mistress," for it was the royal custom in those days to reverse the combination. Seymour would not have to "seek an historical parallel" to his revered Colonel. He can hardly open the memoirs of any of the frail beauties or gay gentlemen of the 17th, 18th or 19th centuries, who took time from their pleasures to scribble in a diary, without coming upon confidantés of kings. It was a dangerous profession in those days, for the favorite usually lost his head when he lost favor. But it is not necessary to look beyond the United States for other Colonel Houses; McKinley had Hanna; in humbler places there are smaller Houses. Military life has its fair share and there is rarely a staff without some member who enjoys the friendship and confidence of the chief to a greater degree than all others.

It is doubtful if the reflective reader will agree with Seymour that even House was compounded of all the virtues that animated Louis Blanc, Mazzini, and Benjamin Franklin. If House really was tickled by the thought that "he was actually deflecting the currents of history," he was suffering from a very common emotion and one that has inspired many other ambitious people. House may have avoided turning his book into an "apologia" by securing Seymour's services, but his merits are bound to suffer from the unwise and immoderate praise heaped upon him by his Boswell. If House only suffered it would not be of moment but Seymour's fulsomeness makes it difficult for a reader to obtain a correct understanding of the history of the White House in the Wilson administration.

House was born in Houston, Texas, in 1858; at eleven years he suffered brain fever which left him susceptible to malaria and unable to endure heat. He was reared in comfortable circumstances and at fourteen was sent first to Virginia then to Connecticut to school. He endeavored to enter Yale but failed, (one of his few failures recorded by Seymour) and finally by the aid of a private tutor was entered at Cornell, where he took more interests in politics than in his books.

His father's death recalled House to Texas before he completed the course at Cornell, and in 1892 he entered politics, as the real manager of Hogg's campaign for governor. Some one else was in nominal charge but the "silent partner who directed all the moves was House who after returning to Texas had spent ten years watching the mechanism of state politics, pondering the mistakes of politicians and developing personal contacts." In 1894, House forced Hogg to agree to the nomination of Charles A. Culberson for governor, and for the only time in his career House "openly assumed the chairmanship of a campaign." According to House, and his biographer, from this time on he really dominated Texas politics, but by 1896, his successes bored him and he commenced to watch for an opportunity to inject himself into the national political arena.

Bryan and free silver kept him out of the arena in 1896, 1900, and 1908. Parker and eastern conservatives kept him out of the 1904 campaign and it began to look as if the country was going to lose the services of the Colonel for his Louis Blanc-Mazzini-Franklin complexes kept him out of

all but private fights. But the Colonel increased his friends among both sides during this time and while he refused overtures to assist Bryan he entertained the Bryan family and cultivated the friendship of Mrs. Bryan. He was no less diligent among the conservative democrats and he widened the circle of his eastern friends.

By 1910 dissensions among the republicans were apparent to all and the election of a democratic House of Representatives foretold the coming democratic presidency. House's long vigil was over and he came east to seek a democrat whom he could make president. His biographer praises the deliberateness of House in biding his time, but to the unterrified democrats who three times rallied to Bryan's clarion call and who went as unafraid to certain defeat under the stalwart Parker, the zeal of the Texan may seem lukewarm. He surely showed during these sixteen years no desire "to hasten the advent of a system which would protect the weak—from exploitation by the strong," and he showed he could control "his longing to play an influential if not decisive part in politics."

House's first choice for the democratic nominee was Mayor Gaynor, a very original mayor of Greater New York, but when that cheerful and philosophical political cynic refused to visit Austin to receive the Texas annointment the Colonel decided Gaynor was not presidential timber. On small decisions hang great events! When Colonel House turned his back on Gaynor his choice fell upon Governor Woodrow Wilson of New Jersey "as being the only man in the east, who measured up to the office for which he was a candidate."

Wilson attracted House's attention by the progressive legislation he had forced through the New Jersey legislature, but House was only following in the wake of men like Harvey, Page, and Watterson who had been planning and working to place Wilson in the White House for two years before House decided to support him. House even then tempered his praise of Wilson and he wrote, "The people seldom take the man best-fitted for the job; therefore it is necessary to work for the best man who can be nominated and elected; and just now Wilson seems to be that man", also "Wilson is not the biggest man I have met but he is one of pleasantest." This was House's impression of Wilson soon after their first meeting which House had arranged at the Hotel Gotham, New York, in November, 1911.

In 1916 House wrote "From that first meeting—I have been in as close touch with Woodrow Wilson as with any man I have ever known . . . . we soon learned to know what each other was thinking without either having expressed himself." Within a few weeks after their first meeting they had become intimates and Wilson remarked "My dear friend, we have known one another always," and House agreed.

After Wilson's amiability, House noted his amenability to advice. House wrote at the time, "and I think he is going to be a man one can advise with some degree of satisfaction," and forthwith proceeded to advise Wilson himself and to get Chancellor Houston of St. Louis, afterwards Wilson's Secretary of Agriculture, to do likewise. It is possible that this

was the moment that House selected himself for Wilson's premier adviser. And certainly from this time until the break in their friendship, after the armistice, Wilson never lacked advice from House on any subject.

House took an active part in the fight for Wilson delegates to the democratic convention but despite his Texas political experience, his actual contribution to Wilson's nomination was the Texas delegation and much advice. The papers give the impression that House directed the Wilson fight and make no mention of the part played by A. Mitchell Palmer and Vance McCormick who delivered the Pennsylvania delegation, nor a half dozen others who played equally important parts.

House left for Europe on the eve of the convention, with his candidate a bad second to Champ Clark, the leading democratic candidate. McCombs, Wilson's manager, who was probably in worse health than House, remained to direct the fight at Baltimore and received much advice from House who was "sure he [McCombs] needed what suggestions and coaching I might be able to give him in regard to handling conventions. . . . ."

Immediately before sailing House wrote Wilson two letters and if House's reputation as a political prophet depended solely on those two letters it would be small indeed, for he apparently believed that Clark's strength would crumble on the second or third ballot and that Wilson would be nominated forthwith; and feared that if Clark gained after the first ballots he would be nominated. Actually the Clark delegates, except Bryan, were unusually loyal and Clark gained votes until the twentieth ballot, yet the Wilson forces, nominally at least, led by McCombs, won. The most powerful individual at the convention was Bryan and when he broke with Clark the convention quickly turned to Wilson. Seymour claims that House was responsible for Bryan's swing to Wilson, but there is evidence that before he knew House, Wilson realized that Bryan's support was essential to success and to gain his friendship Wilson parted with Harvey and Watterson, and made handsome amends at the Jackson dinner in January, 1912, for an uncomplimentary remark he had once written concerning Bryan.

There were at least three crises at the Baltimore convention that Wilson had to confront and pass before securing the nomination; he was aided by several very able lieutenants but at Seagirt he was in easy telephone communication with Baltimore and all major decisions were referred to him. At the most critical juncture McCombs recommended that the Wilson delegates be released and was told by Wilson to stand fast. In truth Bryan, Palmer, McCormick, McCombs, and Tumulty and many others had more to do with nominating Wilson than House, and it would hardly be overstating the case to add that Wilson himself took considerable part in securing the nomination.

William Allen White says of the Baltimore convention,—"Then after seven days of wrestling and seven nights of vain conspiracy and bickering, by some miracle beyond explanation . . . . without the aid of great strategies on the floor, without the aid of wise managers in the convention lobbies, the Wilson spirit had dragged this thing (the nomination) out of the hearts

of a reluctant party." White is a Wilson partisan but his estimate of the convention will find more believers than Seymour's.

House had promised to return immediately if Wilson was nominated, but he was so sure the republican split would elect Wilson that he delayed his return until August. As soon as he returned he discovered, what the whole political world knew, that there was friction between McCombs and McAdoo and in the nick of time stepped into the breach. In due time Wilson was elected as every one knew he would be, and House, anticipating that Wilson would need some advice about his cabinet and other major appointments, had a complete slate prepared for the President elect. Probably House slightly overestimated his part in selecting the appointees but there is corroborative evidence that he had much influence in selecting the cabinet, and House himself adds that the cabinet members were selected primarily for their influence with Congress and not for their ability as administrators. For political reasons Bryan, the long time national leader of the party, was made Secretary of State and also consulted about the other members of the cabinet. The desirability of the executive guiding Congress sufficiently to carry out a party program of legislation is apparent but it should not be necessary to sacrifice administrative efficiency at one end of Pennsylvania avenue to secure sufficient leadership at the other end to carry through a party program. House realized the shortcomings of many of the appointees and had the grace to apologize to his injured countrymen for recommending them.

About this time, possibly soon after his inauguration, Wilson replied to a politician's inquiry "Mr. House is my second personality. He is my independent self. . . . ." And these two intimates arranged a code to permit discussion of men without fear of discovery.

In selecting the cabinet House refused a place for himself but took good care of Texas with two portfolios at first and a third later. Having arranged the cabinet, revised the tariff, passed the new currency act, House turned his eyes towards Europe, discovered the imminence of the World War and hastened abroad to prevent it. He arrived in Berlin in May, 1914, and had a long conversation with the Kaiser who told him much about the Yellow Peril and his Grandmother Victoria, but very little about disarmament except its impracticability. House had carefully prepared himself for this undertaking by informing himself about the Kaiser and his entourage from Americans versed in German affairs and acquainted with German officials. House's plan for world peace was based on a sympathetic understanding between Great Britain, Germany, Japan, and the United States. He thought the peace of the world could be guaranteed by these four powers. He was correct, the only difficulty lay in reconciling the aims of the four states. House thought Germany could be given a zone of influence in Asia Minor and Persia and encouraged to hope that she might be given a freer hand commercially in Central and South America.

Grey, who had already divided Persia with Russia and who was more or less committed to French ambitions in Asia Minor, but who was even

then working towards an agreement with Germany which would have given her extensive rights in Mesopotamia, provided England's interests could be safeguarded by certain concessions in the Persian Gulf, must have been amused by the naïve suggestions of House. And when the passion of House for the weak against the strong is recalled, his willingness to purchase peace at the expense of the weaker nations in both hemispheres is surprising. In fact House was only reverting to time worn formulas, long familiar in European chancelleries. House's plan, which Seymour labels the Great Adventure, did not even have the charm of novelty to Europeans and his helpless American constituents, had they been in the secret, would scarcely have thanked him for introducing the Germans into South America any faster than their native energy and efficiency were then taking them.

House further showed his ignorance of European affairs by regarding Russia as "the greatest menace to England." Poor Russia, the despair of her friends, on the verge of a revolution, ruled jointly by the Czar, Czarina, and Rasputin was only a menace to herself. A decade had passed since Japan had shown the world the feebleness of Russia and yet the man selected by the President of the United States to tell Europe how to compose its troubles, regarded Russia as Great Britain's greatest menace.

House was little wiser in some of his estimates of foreign diplomats for he regarded Zimmerman, who conceived the idea of Mexico conquering our southwestern states, as the ablest man in the German foreign office, and he regarded von Bernstorff as an honest upright Ambassador entirely ignorant of the outrageous plans being carried out under the direction of Boy Ed and von Papen to destroy munition factories in the United States. Bernstorff, on the contrary, was wise enough to recognize House's influence with Wilson as early as May, 1913, and through a prominent German-American arranged a luncheon for House at which he patiently listened to House's ideas on world politics and suggested that China would be a field where the four powers, Great Britain, United States, Germany, and Japan could work in concert and bring about a good understanding between themselves. This thinly veiled invitation to the United States to join in the division of China into spheres of influence was not even sensed by House who thought the plan was good and later naïvely repeated the conversation to Grey as evidence of the friendliness of Germany for Great Britain. House repeatedly and justly laments Wilson's lack of interest in foreign affairs, but when Wilson did turn his attention to Europe he was not as guileless as the Texan.

The plans House offered to restore peace in Europe are described in detail by Seymour and form the most interesting and important part of the papers for the naval officer. These plans, as is already known, all failed but they reflect the mind of the President of the United States at a time when she was the only large neutral and in consequence held a commanding place in world affairs. At first Wilson believed the United States would be able to avoid the war and seems to have been opposed to any increase in armaments mainly because he thought union labor would be opposed to a larger standing army.

Wilson's first foreign concern was Mexico, then he forced the repeal of the Panama Canal tolls, meanwhile Bryan was arranging his "cooling off" treaties with various nations before House undertook to manage our foreign affairs as minister without portfolio. But according to Seymour, House had carefully prepared himself for this task too, for "During his career in Texas he had never ceased to study current diplomacy," he now desired "to help in the formulation of a positive foreign policy." House therefore proposed to substitute a Pan American doctrine for the Monroe Doctrine, and regardless of the wisdom of his proposal it is almost certain that his adopted American constituents would have resented his well intentioned efforts to improve on the long accepted corner stone of their foreign policy. Some of the South Americans were doubtful about the House amendment to the Monroe Doctrine and Chile promptly called attention to a disputed boundary between her and Peru and wished to know the effect of the new agreement on her claims. House was undaunted by such trifles but Chile refused to be precipitate and the agreement was left unsigned.

House believed "that the republics of the two continents should agree to guarantee each other's territorial integrity and to government ownership of munitions of war." These two agreements, together with Bryan's "cooling off" treaties, House thought would preserve peace in the western hemisphere and be a model to Europe. The negotiations began in December, 1914, but the hesitation of Chile prevented any action and the pressure of the World War prevented House from giving it his personal attention, but as late as February 20, 1916, he sought Grey's support of this pact in Parliament, on the ground that Great Britain was one of the largest American powers and this pact offered "one way (for Great Britain) to bring about a sympathetic alliance not only with the United States but with the entire western hemisphere." Grey enthused over the idea, and well he might, for he had been struggling to retain the benevolent neutrality of the United States when he was suddenly offered an alliance with her by the intimate friend of her President. Bonar Law, more cautious than Grey, and perhaps skeptical of the ability of House to consummate the alliance, thought the question should be considered by Canada before being discussed in Parliament. The opposition to Chile killed the alliance and Great Britain refused to consider the pact until it was agreed upon in the western hemisphere and so the Monroe Doctrine survived *Philip Dru.*

House returned from his first peace mission to Europe barely in time to avoid the stampede of homeward bound Americans fleeing the World War, and thereafter laments that had he been a little earlier or the British a little less deliberate he might have saved Europe. If House really thought his earlier arrival in Europe would have enabled him to prevent the European war, his delay must rest heavily on his conscience for he had enjoyed Wilson's confidence for over two years, he had been preparing for foreign affairs from his youth and Wilson had been in power seventeen months when the war started. The Atlantic can be crossed in a week and House knew the transatlantic steamer schedules. House and Seymour both gave

their imaginations free rein when they suggest that a few days more of House in Europe might have prevented the World War.

The informed reader will readily absolve House from dilatorily permitting the World War but may be amused at the self-esteem so engagingly revealed by the discreet Colonel. House having failed to prevent the World War was naturally alert to end it as rapidly as possible. His acquaintances included the ambassadors and ministers of all belligerent powers. He was the accepted spokesman of President Wilson and alternately consulted Spring-Rice, British Ambassador, and von Bernstorff, German Ambassador. It is evident that Bernstorff was more successful in handling House than was Spring-Rice. In first discussing terms of peace House only offered generalities such as *freedom of the seas,* and *reduction of armaments,* and he usually could get the opposing sides to agree in principle to the overthrow of militarism and navalism. When he approached the real issues of the war such as Alsace and Lorraine, the possession of Constantinople and the various spheres of influence, protectorates and colonies he found that the belligerents were willing to fight for their possessions, past, present, and prospective.

House's methods of approach are not beyond criticism. He always claimed to talk with equal frankness to both sides, and believed that they usually reciprocated. As he was in possession of valuable information of all belligerent countries it is obvious that he could not be entirely frank with all parties without betraying information given him in strictest confidence. For example, House's prophecy in London after a visit to Berlin that Germany would attack Verdun was of doubtful propriety in view of the semi-confidential terms he was on with German leaders. House in Germany, France, and England always endeavored to persuade the country concerned that its opponents were stronger. He desired to frighten the leaders on both sides into a peaceful frame of mind. This is somewhat similar to the German idea that she could frighten the world into accepting its domination.

House's peace plans eventually culminated in the proposal that the President would call on both belligerents to "stop this destructive war." House first suggested to Wilson in the autumn of 1915 "to ask the allies, unofficially, to let me know whether or not it would be agreeable to them to have us demand the hostilities cease . . . . upon the high ground that the neutral world was suffering along with the belligerents . . . . and that the peace parleys should begin upon the broad basis of both military and naval disarmament. . . . . *If the Allies understand our purpose, we could be as severe in our language with them as we were with the Central Powers.* The allies, after some hesitation, could accept our offer or demand and if the Central Powers accepted, we would then have accomplished a masterstroke of diplomacy. If the Central Powers refused to acquiesce we could then push our insistence to a point where diplomatic relation could be broken off, and later the whole force of our government—and perhaps the force of every neutral—might be brought against them." House believed the President acquiesced in the plan, which he afterward discussed with

Lansing, who agreed. House then requested Grey to let him know when a favorable opportunity to intervene arose. House did not neglect to warn Grey of the danger of waiting too long before accepting this offer.

While apparently willing to intervene in the war on behalf of generalities, House was advising Bernstorff the exact amount of concession Germany would have to make in the *Arabic* sinking to prevent Wilson sending him home. When Bernstorff succeeded in getting Berlin to confirm his promises made in accordance with House's suggestions, House then advised Wilson to accept Berlin's promises. It is difficult to understand House's actions in this situation for Gerard informed House that the German naval "people frankly announce that they will not stop submarining, no matter what concessions are made by the Chancellor. . . . ." House wrote Gerard that "If it had not been for his [Bernstorff's] patience, good sense and untiring effort, we should now be at war with Germany." Some at least of the "patience" which prevented a rupture with Germany was exercised by Wilson who in late September said his chief puzzle was "to determine where patience ceases to be a virtue." House through Seymour disclaims much of the responsibility for Wilson's patience, yet on this occasion at least he advised Wilson to do nothing about the *Arabic*.

Grey's reply to House's proposal for intervening was sufficiently encouraging to cause House to make preparations for another trip to Europe, and in December Bernstorff reported that the German government would like House to come directly to Berlin to discuss peace upon the general terms of military and naval disarmament. House accepted the German invitation but told Bernstorff it was necessary to visit London en route to Berlin and "we were not concerned regarding territorial questions or indemnity. . . . ." The United States was the only country in the world at that time which was interested in disarmament, all the others were making every effort to increase their armaments, the British Government had already been reorganized because of a shell shortage; and Lloyd George was the most popular member of the government because he was speeding up the manufacture of munitions. The United States was also the only country which was not concerned with "territorial questions or indemnity"; in Europe those were the difficult questions and could an agreement have been reached on them peace would have probably followed. House postponed the decision by writing Wilson "The allies will take care of the territorial and indemnity questions, and we need not go into them at this time."

House made his trip to Europe, saw the same people he had seen before, indulged in the same generalities and finally realized that neither side was willing to submit to a negotiated peace. Germany successful on the continent, with her armies entrenched in enemy soil was in no mood for disarmament, withdrawals, and indemnity. The allies thought they could overcome the German land superiority sufficiently to enforce peace, and even a peace lover like Bryce was determined to finish the war rather than live in dread of another. France could not afford to make peace, and become a second rate nation. Germany was much too proud of her army's achievements to reduce it.

Seymour quotes Churchill on the horrors of the war of exhaustion but it is the only form of war that high spirited and determined people engage in; the South suffered such a war before submitting to the North in the Civil War. Churchill and House both dreamed of victories without losses, Churchill depended on brilliant strokes of a heaven sent genius; House depended on the methods successfully employed in Texas conventions, the conference method, whereby discreet whispering and much visiting between delegations would nominate his candidate, and endorse his platform. Europe was not Texas and the Colonel's soft voice and step could not solve Europe's problem, nor could any amount of soothing words decide which European group should have Constantinople and Antwerp. These prizes were worth fighting for and all Europe knew it and in 1916 Europe was still willing to fight for them.

In the fall of 1916 House was again busy in Wilson's campaign for re-election; Seymour with his usual modesty claims that House reelected Wilson. The campaign is too well remembered to recall the many people who claimed to have reelected Wilson. House says of the campaign the democrats had "the only efficient organization that has ever been constructed in a democratic national campaign." After that remark the reader will not be surprised to learn that House organized it. Yet Secretary Houston, formerly of Texas and a close friend of House in correctly prophesying Wilson's election, said "The President will be reelected . . . . but the outcome will not be due to any excellency of the democratic organization . . . . he will be re-elected in spite of the imperfection of the organization locally. (Washington Headquarters)."

House claims never to have been in doubt about the outcome, yet he persuaded Wilson to agree to resign the presidency immediately after the election if defeated, in order to pave the way for Hughes' immediate assumption of office. This apparent contradiction is not explained by Seymour, and during "the uncertain hours of Tuesday night, November 7, both the President and Mrs. Wilson were cheered, as I [House] was by the thought of the dramatic dénouement we had in mind in the event of defeat." This sounds theatrical from a man who hated publicity.

After his reelection Wilson called upon the belligerents to state their aims so that a common basis of understanding could be reached. This peace move was complicated by coming soon after Germany's peace offer; the allies were further offended by the Wilson phraseology and no results were obtained. In February, 1917, came the final break, the country drifted broadside-to into war which was declared on April 7. Thus far goes House's papers and it will be a well informed reader indeed who can not profit by a careful perusal of them. They will be better understood if the following books are read in connection with them: Lane, *Life and Letters,* Tumulty, *Wilson as I Knew Him,* W. A. White, *Life of Wilson,* Lansing, *The Peace Conference.*

After considering the advantages and disadvantages of an unofficial adviser to the President of the United States few reflecting readers will hesitate to condemn the practice. The Constitution provides that the Cabinet

must be confirmed by the Senate and in the present administration the Senate has not hesitated to exercise its veto on cabinet nominees.

Readers of the papers will probably disagree whether the substance of House's advice to Wilson was on the whole to the advantage of the country. An accurate determination of that question will have to await the publication of Wilson's letters and one probable good effect of the House papers will be to hasten their publication.

Curious readers may wonder why Wilson selected House for his confidante. The real reason was probably only known to Wilson. The following explanation is suggested; one of Wilson's friends said that Wilson never accepted advice unless "it was massaged in." By this he meant that Wilson would not listen to a downright argument or discussion, he was too long a professor to enjoy a real clash of minds. House himself attributed some of his success with Wilson to his method of gradual approach. If his letters to Wilson are carefully studied it will be noted that they practically all contain some complimentary remark or some appeal to Wilson's vanity; House's favorite remark was to recall to Wilson his future in history. In passing, most favorites have used the vanity highway to the hearts of the great.

Seymour praises House's bravery when he told Wilson ". . . . he was too refined, too civilized, too intellectual not to see the incongruity and absurdity of war. It needs a man of coarser fiber and one less a philosopher than the President (Wilson), to conduct a brutal, vigorous, and successful war." House also thought waging successful war would not be so difficult as "taking a more or less ignorant, disorganized party in Congress and forcing it to pass the Federal Reserve Act, the Tariff Act, the Panama Tolls Act. . . . ." If Washington had not waged brutal, vigorous, and successful war our country had not been founded; if Polk had not made aggressive war House might have been advising Huerta instead of Wilson; if Lincoln had not been willing to wage brutal, vigorous, and successful war our country had not endured; if McKinley had not been willing to wage aggressive, vigorous, and successful war Cuba would not be free and we would not be a world power.

House considered himself "a pacifist as far as international affairs are concerned. . . . . But as an individual I have not been able to escape the conviction that there are occasions when a man must be prepared to fight." Life in Texas had shown him that it might be necessary for an individual to fight but all his study of history and experience had not shown him that a nation may also be called upon to fight. House complains that Wilson did not prepare the Army and Navy when advised by him to do so and he states correctly that had Wilson done so Germany would not have engaged in ruthless submarine war. Yet after his first rebuff he did not again urge Wilson to prepare for war and according to Tumulty it was on his advice that Wilson first led a preparedness parade and began to urge an increase of the Army and Navy.

It appears from other sources that Wilson was far from being as docile under the tutelage of House as Seymour implies and that occasionally at

least House first found out what Wilson wanted and then advised it. House complains that against his advice Wilson did many things which afterwards turned out badly but Seymour is alert to claim for the Colonel those things which subsequent events justified.

The *Intimate Papers,* temporarily at least, will injure Wilson's reputation without adding to House's, and unless Wilson's papers are produced in time to efface the impression created by House the injury may be permanent. If the publication of these papers will encourage future presidents to confine official affairs to their official advisers the country will profit more by the publication of House's papers than it did by his advice to Wilson.

W. D. P.

OUR NAVY AND DEFENDERS. By J. M. Colasanti. The author, Portsmouth, Va. $3.00. 96 pages, cloth bound.

To any one seeking a pictorial account of our Navy, together with an immense amount of additional information as regards types of ships, the book will be very valuable. The first edition of the book contained a letter of appreciation by George Dewey, dated June 10, 1905. This, the 1926 edition, has been brought up to date and, in addition to the pictorial part referred to above as regards types of ships, contains other pictures and data in regard to aircraft, a history of Navy Day, a short history of the Naval Academy, War College, and certain naval stations. There are also pictures and data of the Panama Canal, insignia designating rank and corps of commissioned and warrant officers, marks on enlisted men's uniforms, together with clear reproductions of ribbons of decorations, medals and badges as worn by the U. S. Navy.

H. A. B.

THE NEWEST NAVIGATION AND AVIATION ALTITUDE AND AZIMUTH TABLES, by Commander Radler de Aquino, Brazilian Navy. J. D. Potter, London. 21 shillings ($5.00).

The advertisement on the inside back cover of the May, 1926 issue of the PROCEEDINGS of Commander Aquino's book was more in the nature of a testimonial and homage to past navigators and commemorated the fiftieth anniversary of the publication, in May, 1876, of Lord Kelvin's *Table for Facilitating Sumner's Method at Sea,* and the author did not call attention to the publisher or to the price of the book. The Naval Institute is therefore very glad to announce the publisher and price above. The book department of the Naval Institute will be very glad to order this book for anyone for $5.00, postpaid, thus making it unnecessary for the purchaser to write to England and pay additional postage.

NAVAL ENCOUNTER BETWEEN THE "KEARSARGE" AND THE "ALABAMA" FOUGHT IN SIGHT OF CHERBOURG, FRANCE, ON JUNE 19, 1864*

By Paul Barbet

(See page 1582, this issue)

Editor's Note: This article is reprinted through the courtesy of the *Marine Journal* from its issue of 19 June, 1926.

THE manner in which the old *Kearsarge* came to her end was related in *The Marine Journal* of February 7, 1925, and it may be of interest to our readers to review the circumstances of the historic conflict off the harbor of Cherbourg on June 19, 1864, resulting in the defeat and sinking of the *Alabama,* which have here been assembled from the original sources in Cherbourg.

The Confederate sloop-of-war *Alabama* whose audacious career under the command of Captain Rafael Semmes has often been related, arrived in the harbor of Cherbourg, France, on June 11, 1864, coming from the Cape of Good Hope, from whence she had sailed on March 23, and here she was met by her deadly enemy, the *Kearsarge,* commanded by Captain John A. Winslow, who although a Southerner had embraced the cause of the North.

While the *Alabama* was anchored in the roads, the *Kearsarge* remained outside to keep a close watch on the movements of her enemy without violating the regulation providing that when two belligerent vessels are together in a neutral port they may leave the port only one at a time and with an interval of twenty-four hours.

The inhabitants of Cherbourg scarcely expected the battle although they were well aware that a challenge in due form had been sent by Captain Winslow to the commander of the Confederate vessel. Captain Semmes had been urged not to attempt the conflict but had replied that he desired to prove to the most skeptical that he was not a privateer attacking only merchant vessels, and that after receiving the opinions of several French officers who had

*From information assembled from original sources at Cherbourg.

declared that were they in his position they would engage in battle, he had decided to do so, thereby placing honor above the dictates of policy. For this decision no one could blame him.

On Saturday evening, June 18, Captain Semmes had told Mr. Bonfils: "I am a Roman Catholic like you. I will not be able to attend the divine service. Promise me to attend the mass and have it said for my hopes." This request was religiously executed.

The members of the crew of the *Alabama* also visited the local representative of the Confederate States and entrusted their valuables and papers to him, with instructions as to the disposal of same should the Confederate vessel meet with misfortune. The funds of the vessel, composed of six million francs in currency and $20,000 in ingots, were landed, the former having been deposited with a local banker, the latter with the Custom House.

Those in ignorance of these details were soon convinced of the immovable resolution of the Confederate captain when at 10 A.M. on Sunday, June 19, 1864, they saw the *Alabama* clear the port by the western entrance, and, changing her course, steer toward the *Kearsarge,* which had been cruising back and forth outside the breakwater for the past four days and nights, and was coming just then from the east.

Following, it is believed, instructions addressed to the commander of the Federal vessel by Mr. Dayton, representative of the Northern states at Paris, directing Captain Winslow to offer to accept battle only at a distance of at least six miles from shore, the first shot was fired at 11 A.M. by the *Alabama* as both opponents were about eight miles from the breakwater. The *Kearsarge* replied a few minutes later and the battle was thereupon engaged with great vigor.

From the very start of the battle both opponents presented to each other their port sides, circling one around the other as the Confederate vessel endeavored to board the *Kearsarge.* Gunshots and bombs were exchanged, more numerous but not so well aimed on the part of the *Alabama,* whose gunners were not so experienced as those of her opponent.

Nevertheless, the *Kearsarge* received a cannon ball in her side at the very outset which would have been sufficient to sink her had it not been for her chain armor, the existence of which was unknown to Captain Semmes.

The machinery of the *Alabama* had been hit and the crew were fighting and working in water to their knees when a decisive shot

THE U.S.S. "KEARSARGE" (PICTURE TAKEN AFTER THE WAR)

destroyed the screw and smashed the sternpost, causing the vessel to immediately start sinking.

The *Alabama* by that time had slackened its fire and was endeavoring to approach the French coast but was still suffering from the fire of her enemy, which continued shooting.

The water was entering freely into the Confederate vessel and had drowned the fires in its boilers, thereby depriving it from all hope of salvation. Captain Semmes then lowered this flag and sent out a boat to inform the captain of the *Kearsarge* of the condition she was in, wishing thus to put an end to the enemy's fire. The *Kearsarge,* however, fired several more shots, affecting not to have noticed the lowering of Captain Semmes' flag, although only six hundred yards separated both opponents, which resulted in the wounding of several members of the crew of the sinking vessel.

A British yacht, the *Deerhound,* belonging to Sir John Lancaster, who was present on board, and which plied between Cherbourg and Southampton, had witnessed the battle from a distance, and proceeding in the midst of the swimming members of the crew, rescued forty men among whom were Captain Semmes and thirteen officers. Those who could not swim were placed in the two boats that had been captured by the *Alabama.* It was only after the complete disappearance of the *Alabama* that the *Kearsarge* launched its lifeboats. French pilot boats, which fortunately were in the neighborhood, succeeded in saving the rest of the survivors.

Captain Semmes and the other members of the crew who were saved by the *Deerhound* were landed that same evening at Southampton. In making his official report of the encounter there, Captain Semmes declared that every man on board his vessel had done his duty bravely and worthily, and that "All was lost save honor."

Those of the *Alabama's* crew rescued by the French pilots were landed at Cherbourg, and thereupon an argument arose between Captain John A. Winslow and the local representative of the Confederates. Captain Winslow, considering that these men were his prisoners, addressed a letter to Mr. Bonfils requesting that they present themselves on board his vessel and duly constitute themselves prisoners of war. Mr. Bonfils replied that this request should have been addressed to the French authorities, on whose soil these unfortunates had found refuge, as this matter was utterly beyond

his jurisdiction. He added that he knew of no law that prohibited a soldier from escaping from the battlefield after a defeat, even though he may have previously been made prisoner, and that he did not understand why a sailor could not do the same by swimming.

This matter did not go further.

On the other hand, certain French newspapers in favor of the Confederates carried on a campaign with a view to obtaining the release of the officers of the *Alabama* who had been detained as prisoners on board the *Kearsarge,* but this campaign was no more successful than had been the request of Captain Winslow, and the *Kearsarge* left the Cherbourg harbor at 11:30 P.M. on the fifth of July, taking along as prisoners of war the four officers of the *Alabama* who had been rescued from the water after the sinking of the Confederate vessel.

And thus, after a battle lasting only an hour and a half, the *Alabama,* which had so often been the victor, was finally sunk by her implacable enemy, the *Kearsarge.*

After this victory the Northern states requested an indemnity for the damages caused by the *Alabama* in view of the responsibility of England, who had permitted the *Alabama* to be built at Birkenhead, near Liverpool, and to embark on its career as a privateer. These so-called "Alabama Claims" caused a tension between the two countries so great that for a time war was feared.

At the Treaty of Washington, in 1866, the United States proposed the arbitration of the claims, which was accepted by England, and the Court of Arbitration of Geneva decided that England should pay fifteen million dollars as indemnity. The case became an important precedent in favor of the general use of arbitration.

Three well-kept graves marking the resting place of the casualties of this historic encounter can still be seen in the cemetery of Cherbourg, where they occupy an elevated position on the hillside overlooking the harbor, as if they had been placed there intentionally so that they might keep eternal watch over the place where their beloved vessel disappeared forever in the waters of the English Channel.

Thus the heroes of both North and South who fought to the death in these waters now rest side by side, on the soil of France, united in death, while their descendants now happily united in

the Great Republic of the West have long since lost even the scars of that terrible conflict.

Under the sod and the dew,
Waiting the Judgment Day—
Under the one, the Blue,
Under the other, the Gray.

(Editorial note of *Marine Journal*)—The official records of the battle differ slightly from Mr. Barbet's in that they state that the ships were engaged on their starboard sides.

Evidently the gunners of the *Kearsarge* were more efficient, though it is recorded that the leading men of the *Alabama* were from the British gunnery ship *Excellent*. Captain Winslow relates in his reports that only two of his boats were undamaged so that they could be used for picking up the survivors. He was also blamed in his own country for allowing the British yacht *Deerhound* to pick up and deliver to an English port the greater number of the survivors, including the captain and most of the officers. However, of the prisoners picked up, he released on parole all but the officers, on account of the crowded condition of the *Kearsarge*, and the fact that he anticipated meeting another Confederate ship, reported to be in the vicinity, so that the escape of the men on the *Deerhound* was not a great matter.

The illustration shows the *Alabama* rigged as a ship, with yards on the mizzen, though she is always referred to as a bark, with no yards on that aftermast. It is interesting to note that the official records state that some few days before the battle yards were crossed on the mizzen, as a disguise, so it can be presumed that the picture is correct, doubtless from the description of eyewitnesses. It seems natural that this accurate information might have been given to the painter by the pilot, and in return the painter gave the pilot the prominent position in the foreground.

SECRETARY'S NOTES

Circulation

The circulation of the PROCEEDINGS since January, 1926, has increased 530 copies; the membership of the Institute, since January, has increased 290 members.

Polar Navigation

For those who are interested in the navigational instruments and methods of polar navigation, employed by Lieutenant Commander Byrd, in his flight to the North Pole, attention is invited to two articles in the August, 1925, issue of the PROCEEDINGS, entitled "Flying Over the Polar Sea," by Lieutenant Commander R. E. Byrd, and "Finding Geographical Position in the Region of the North Pole," by G. W. Littlehales.

The instruments and methods therein described are exactly the same as used in the flight by Lieutenant Commander Byrd to the Pole this year. Particular attention is invited to the description and use of the Bumstead sun compass, invented by Albert H. Bumstead of the National Geographic Society. Lieutenant Commander Byrd, in his talk before the guests of the National Geographic Society on June 23, laid particular stress upon the usefulness of this instrument during his flight.

Lieutenant Commander Byrd also gave no little credit to the National Geographic Society in that the experiences of the expedition last year under the auspices of that society greatly assisted in making the flight to the Pole successful this year.

The Great Shipping Problem

"The Great Shipping Problem," by Captain Charles Conard, (SC) U. S. Navy, the leading article in the June PROCEEDINGS, has attracted considerable attention in the shipping world. The Naval Institute granted permission to the *Marine Journal* to publish the article in full and the same was published in its weekly issue of Saturday, June 26, 1926. The U. S. Shipping Board has also displayed considerable interest in this article.

Photos Many opportunities should present themselves to the readers of the PROCEEDINGS to get interesting pictures, and it has been decided to add a picture department to the PROCEEDINGS by beginning on a small scale. Many interesting pictures are taken by the regular commercial companies, and there appears to be no reason why just as many interesting ones should not be taken by our members for publication in the PROCEEDINGS.

The Institute would therefore be pleased to receive photos of especial interest, and, if found acceptable, payment will be made for same, in addition to the usual courtesy acknowledgment when and if published. Photographs not accepted will not be returned.

Membership: New members not previously published:

Baker, I. P., Mr.
Barron, G. E., Boatswain, (T) U.S.C.G.
Brunsman, C. Def., Mrs.
Cusack, C. J., Mr.
Gonzalez, Rodolfo, Lieut. A. N.
Kobayashi, M., Lieut. Comdr. I.J.N.
Leahy, F. W., U.S.N.R.
Lera, Julio, Lieut. A. N.
Malnate, W. F., Lieut. U.S.C. & G. S.
McDonnell, F.R., Lieut. U.S.N.
Merriam, J. H., Captain, (SC), U.S.N.
Montenegro, G., Lieut. A. N.
Moses, F. W., Mr.
Nichols, Lloyd, Mr.
Rosenthal, J. S., Lieut. (T) U.S.C.G.
Stevenot, J. E. H., Mr.
Thompson, E. M., Lieut. (jg), U.S.N.
Thornton, J. T., Mr.
Williamson, C. H., Mr.

INSTRUCTIONS FOR CONTRIBUTORS AND MEMBERS

Articles The Institute desires articles of interest to all branches of the service, including the reserve force. Non-members as well as members may submit articles, and authors receive due compensation for articles published. **Compact, well digested articles are more likely to be accepted for early publication.** In accepting articles for publication, the Institute reserves the right to have such articles revised or rearranged, where necessary, in order to bring them up to the required standard of articles published in the PROCEEDINGS—the cost, if any, to be deducted from the compensation due the author.

Contributors are requested to observe the following special instructions in preparing articles for the PROCEEDINGS:

(a) In writing names of ships put only the initial letters in capitals and underscore the names. The underscoring signifies to the printer that the word is to be in italics. The same applies to names of publications. Foreign words not anglicized should also be italicized.

(b) In preparing tables and computations employing fractions, subnumbers, etc., do by hand that part which cannot be made perfectly clear by the typewriter.

(c) In typing the script use double space between lines.

(d) When a quotation is included in an article the editor should be assured by appropriate notation that the writer has carefully verified the quotation as presented.

Reprints Authors of published articles are entitled to twenty gratis copies of reprints.

Discussions Discussion of articles published in the PROCEEDINGS is cordially invited. Discussions accepted for publication are paid for at approximately one-half the rate for original articles.

Book Reviews As soon as practicable after the publication of books on subjects of professional interest, the Institute aims to publish authoritative reviews of them, reviewers being remunerated.

Address of Members In the past, many errors have resulted from the habit of changing an officer's address as soon as his transfer orders are published in the papers. No change will be made in the future except upon receipt of notification by the member concerned. Reliance upon the former method may, in extreme cases, mean a delay of almost four months. To insure the prompt delivery of the PROCEEDINGS and other communications from the U. S. Naval Institute, it is essential that members and subscribers *notify the Secretary-Treasurer without delay of every change of address.* No responsibility can be accepted for failure to receive the PROCEEDINGS, where members fail to comply with this rule. Changes of address should reach the Institute by the 23rd of the month, to be effective for the issue of the PROCEEDINGS of the following month.

SPECIAL NOTICE

Naval Institute Prize Essay, 1927

A prize of two hundred dollars with a gold medal, and a life membership in the Institute (unless the author is already a life member, in which case he will receive the commuted value thereof), is offered by the Naval Institute for the best essay submitted on any subject pertaining to the naval profession.

The following rules will govern this competition:

1. The award of the prize to be made by the Board of Control, voting by ballot and without knowledge of the names of the competitors.

2. Each competitor to send his essay to the Secretary-Treasurer in a sealed envelope marked "Prize Essay Contest." The name of the writer shall not appear on the essay, but instead thereof a motto. Accompanying the essay a separate sealed envelope will be sent to the Secretary-Treasurer, with the motto on the outside and the writer's name and motto inside. This envelope will not be opened until after the decision of the board. Essays must be received on or before January 1, 1927.

3. In addition to the "Naval Institute Prize," one or more essays may receive "Honorable Mention," if of sufficient merit to justify that award; or, in the event that no essay is adjudged of sufficient merit to receive the "Prize," the best essay submitted may receive "Honorable Mention" in lieu thereof.

4. In case one or more essays receive "Honorable Mention" the writers thereof will each receive a prize, the amount of such awards to be decided by the Board of Control in each case.

5. Announcement of awards will be made as soon as practicable after January 1, 1927.

6. Essays awarded the "Naval Institute Prize" or "Honorable Mention" will be published in the Naval Institute Proceedings as soon as practicable. Essays not awarded a prize may be published at the discretion of the Board of Control, and the writers of such articles shall be compensated at the established rate for articles not submitted in competition.

7. Articles shall be limited to twenty (20) printed pages in the Proceedings (approximately 8,000 words), but shorter articles will receive equal consideration.

8. In the event of the prize being awarded to the winner of a previous year, a gold clasp suitably engraved will be given in lieu of the medal.

9. All essays must be typewritten, and submitted in duplicate.

H. A. BALDRIDGE,
Captain, U.S.N., Secretary-Treasurer.